California. Dept. of Fish and Game.
Biennial Report 1888-1890.

BIENNIAL REPORT

OF THE

State Board of Fish Commissioners

OF THE

STATE OF CALIFORNIA.

1890.

Calif Dept of Fish & Game
Biennial

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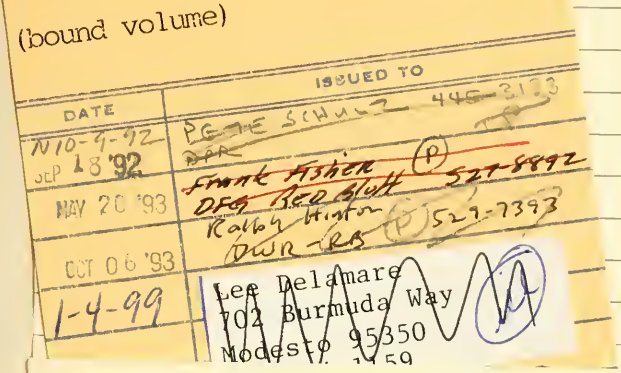

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BIENNIAL REPORT

OF THE

STATE BOARD OF FISH COMMISSIONERS

OF THE

STATE OF CALIFORNIA,

FOR THE

YEARS 1888–1890.

COMMISSIONERS.

JOSEPH ROUTIER, Sacramento, President.
J. DOWNEY HARVEY, San Francisco, Secretary.
CHARLES JOSSELYN, San Francisco.

SACRAMENTO:
STATE OFFICE, : : : : : : : J. D. YOUNG, SUPT. STATE PRINTING.
1890.

REPORT.

To Hon. R. W. WATERMAN, *Governor of the State of California:*

SIR: The undersigned have the honor hereby to present their Second Biennial Report relative to the fish industry of the State.

The fish interests of the State are in a comparatively satisfactory condition.

The spring run of salmon for 1889 was fair, as was also that of 1890. The fall run of 1889 showed improvement over that of the previous years. The supply of shad continues to be large. Carp is found in large quantities in all the waters of the State; they are not a desirable food fish. Sturgeon continues to diminish every year, owing to the indiscriminate slaughter waged upon them by Chinese fishermen. Special efforts have been made to stock the rivers and lakes with the various species of trout. In these efforts we have been quite successful, as evidenced by the astonishment of many at finding them abundant in streams to which they had for years been strangers. This will appear more pointedly in the report of the Superintendent of Hatcheries. Black bass have been distributed in different places throughout the State. The increase of this fish at Crystal Springs, San Mateo County, has been rapid, and is the source from which our supply has been obtained. Catfish have developed into popular favor, and are plentiful in most of the waters of the State.

SEALS AND SEA LIONS.

We respectfully repeat the recommendations of the last report of the Fish Commissioners, as follows: These aquatic animals are a serious detriment to the fish interests of the State. They sit at the entrance of Golden Gate as royal toll gatherers, and take the lion's share of the schools of the finny tribe as they pass from the broad Pacific into the bay of San Francisco, preparatory to an ascent of our rivers. In the opinion of the Commission, they are great destroyers of the salmon. They appear to be more numerous at Seal Rock and around the entrance of San Francisco Bay than in former years, owing, no doubt, to the fact that the fishermen have driven them with their nets from Suisun and San Pablo Bays. They not only guard the entrance of San Francisco Bay, but are found at the entrance of Monterey, Bolenas, Point Arena, Tomales, and Shoalwater Bays. This and former Commissions and the public press have repeatedly invoked legislative action to prevent the immense destruction of fish constantly going on and increasing by these worthless animals. It is highly important to our citizens to have the food of which they are so deprived, and in their behalf remedial legislation is again urgently demanded.

STEAM LAUNCH.

The steam launch "Governor Stoneman," constructed at a cost of over $4,000, was found useless for the service for which it was intended.

In the interest of economy and an efficient service, and in response to an Act of the Legislature, we disposed of it for the sum of $1,100, which money is in the State Treasury for the purchase of other boats suited to economical use in quest of persons engaged in illegal fishing.

HATCHERIES.

The Shebley Hatchery has been abandoned, the supply of water being inadequate. The Hat Creek Hatchery has been abandoned, and it is the desire of the Commission that the Legislature provide for its removal to a more desirable location. The Sisson Hatchery has been a great success. A new hatchery has also been constructed at Lake Tahoe. The details relating to all these hatcheries, will be found in the report of the Superintendent of Hatcheries. The United States Fish Commission have furnished us with all the eyed salmon eggs it is possible for us to handle, for which they are entitled to the thanks of every person in the State.

FISH LADDERS.

Fish ladders have been built in most places where necessary, but many are not properly built, are not kept in repair, and are to a considerable extent inefficient, owing to the fact that the Board has no appropriation from which to defray the expenses of construction.

The last Legislature appropriated $500 for the removal of obstructions at Salmon Falls, in the American River. This has been successfully accomplished.

LICENSES.

The amount received from sales of licenses to fishermen for last year exceeds the sum received for sales of the previous year. The receipts were as follows:

LICENSES FOR THE YEAR 1888.

Received of Controller.	Class.	Value of Each.	On Hand March 31, 1889.	Sold during the Year.	Total Value of Licenses Sold.	Commissions Allowed for Collecting.	Net Amount due the State.
700	A	$5 00	208	492	$2,485 00	$300 01	$2,184 99
100	B	7 50	93	7	52 50	7 87	44 63
100	C	10 00	83	17	170 00	25 50	144 50
100	D	12 50	77	23	287 50	43 12	244 38
5	E	15 00	4	1	15 00	2 25	12 75
Total, 1,005	------	----------	465	540	$3,010 00	$378 75	$2,631 25

LICENSES FOR THE YEAR 1889.

Received of Controller.	Class.	Value of Each.	On Hand March 31, 1890.	Sold during the Year.	Total Value of Licenses Sold.	Commissions Allowed for Collecting.	Net Amount due the State.
775	A	$5 00	19	756	$3,780 00	$356 25	$3,423 75
50	B	7 50	35	15	112 50	16 87	95 63
50	C	10 00	28	22	220 00	31 50	188 50
52	D	12 50	26	26	325 00	48 75	276 25
1	E	15 00	----------	1	15 00	2 25	12 75
Total, 928	------	----------	108	820	$4,452 50	$455 62	$3,996 88

APPROPRIATIONS.

The last Legislature appropriated $20,000, one half of which was to be used for support in each of the forty-first and forty-second fiscal years. The expenditures made will be found in the proper place herein. The sum of $2,000 was appropriated for the purchase and importation of certain game birds into the State. The Board has so far been unable to obtain most of the species named in the Act, but hopes yet to secure them. Some quantities of Chinese quail and Oregon pheasants have been purchased and distributed in accessible localities. These quail have propagated already fairly well, and supplies can soon be had from them for other localities, as required. The $2,000 appropriated for the prosecution of violators of the fish laws has been expended, and was insufficient to defray the costs of prosecutions.

The Oregon pheasants can only be had by sending agents there to buy them in person, and they cannot be had at less than about $15 per pair. So far only forty pairs have been secured. The cost of the Chinese quail is about $20 per hundred. We have obtained about one thousand three hundred so far. These have been distributed pretty widely throughout the State. The amount so far drawn from the appropriations for game birds is $1,500, of which up to this time the sum of $1,020 has been expended.

COUNTY GOVERNMENT BILL.

Section 38 of the Act of March 16, 1889, amending the County Government Act, authorizing the Boards of Supervisors to fix the size of fish net meshes, should be repealed. If one county has one law, and another county another one, it renders it impossible for violators of the law to be punished, and the law thereby becomes inoperative. One county has already fixed the size of meshes for fishing at four inches, instead of the seven and one half inches prescribed by the statutes.

If the Legislature should agree with the recommendations of the Superintendent of Hatcheries for the creation of more hatcheries, the appropriation he asks for, or more, may be necessary. We recommend an appropriation of $10,000 for patrol purposes. If illegal fishing is to be prohibited, men enough to patrol the rivers must be had; otherwise, illegal fishing will go on as usual with impunity.

FOOD FISHES.

In its proper place herein will be found an interesting and instructive paper on the food fishes of this State from the pen of Dr. C. H. Eigenmann, who is regarded as authority upon that subject; also, a letter from Dr. H. W. Harkness, President of the California Academy of Sciences.

WIRE SCREENS FOR IRRIGATION DITCHES.

The millions upon millions of fish, large and small, that pass into the open heads of irrigating ditches, only to die when the water becomes exhausted, will decimate the fish supply faster than it can be restored from all the hatcheries in the State, in those localities where irrigation is largely in use. This has rendered necessary in some of the States the enactment of laws requiring the use of close-meshed wire screens at

the entrance to all irrigating ditches in the State. What is necessary elsewhere, is indispensable here, and we recommend the passage of a law here similar to the following law in the State of Wyoming upon this subject:

Any person or persons, corporation or corporations owning in whole or in part, or leasing, operating, or having in charge any mill-race, irrigating ditch, or canal, taking or receiving its water from any river, creek, or stream in this territory in which fish has been placed or may exist, shall put or cause to be placed and maintained over the inlet of such ditch, canal, or mill-race a wire screen of such construction, fineness, strength, or quality as shall prevent any such fish from entering such ditch, canal, or mill race, when requested to do so by the Fish Commissioner.

Any person or persons, corporation or corporations violating the provisions of the preceding section, or who shall neglect or refuse to provide, put up, and maintain such screen, in accordance with the provisions of the preceding section, shall be guilty of a misdemeanor, and on conviction thereof shall be punished by a fine of not less than ten dollars, and not more than one hundred dollars, or by imprisonment in the county jail not exceeding thirty days for each offense; *provided*, that the continuance by any person of such neglect or refusal from day to day after notification in writing shall constitute a separate and distinct offense for each and every day of the continuance of such neglect or refusal; *provided further*, that no offense shall be committed by reason of such screens not over the inlet of any ditch, canal, or mill-race when water is not entering the same.

LAWS RECOMMENDED.

We desire to renew the recommendations contained in our last biennial report, to wit:

"The close season for salmon should be enlarged. It is now between the thirtieth day of August and the first day of October. It should be from the first day of August to the first day of October. The Commission earnestly recommends legislative remedial action to prevent the destruction of fish by seals and sea lions. We further recommend that the License Act be amended so as to declare the penalty for its violation. We also recommend that a law be passed providing for the confiscation and destruction of all unlawful nets, seines, and traps of any description found in use. The possession of fish out of season, or fish of under size, should be made a misdemeanor. Some legislation should be had regarding the taking of immature fish, and defining 'immature fish,' at least so far as it concerns salmon, shad, sturgeon, and trout."

DEER.

We recommend that the killing of deer be prohibited absolutely for the next two years, and also the having in possession the skin of any deer for the same time. This is rendered necessary because of the great loss of these animals during the extremely severe weather of the last two winters, as well as their indiscriminate slaughter in some localities by hunters who defy the law with impunity. With these men, nothing save the heavy hand of the law can be made effective.

JOSEPH ROUTIER,
J. DOWNEY HARVEY,
Fish Commissioners.

EXPENDITURES

During the Fortieth Fiscal Year, ending June 30, 1889, chargeable against the Appropriation for the Restoration and Preservation of Fish in the waters of the State.

Balance on hand July 1, 1888		$304 93
Warrants issued during fortieth fiscal year for services performed during the thirty-ninth fiscal year:		
By Expenditures.		
Warrant No. 468—To O. P. Egbert, supplies	$13 55	
No. 469—To W. E. Elliott, salary	66 50	
No. 470—To John Howard, salary and expenses	56 50	
No. 471—To Goldberg, Bowen & Co., supplies	37 06	
		173 61
Balance on hand from thirty-ninth year		$131 32
By appropriation (Statutes of California, page 215)		3,750 00
By Expenditures.		
Warrant No. 2226—To J. P. Dalton, salary and expenses	$240 71	
No. 3085—To J. P. Dalton, salary and expenses	714 90	
No. 3086—To O. P. Egbert, supplies	39 15	
No. 3088—To Goldberg, Bowen & Co., supplies	12 38	
No. 3089—To J. G. Woodbury, salary and expenses	173 70	
No. 3090—To W. E. Elliott, salary	60 00	
No. 3091—To John Howard, salary	50 00	
No. 3092—To Charles Wenzinger, salary	50 00	
No. 5519—To John P. Dalton, salary and expenses	310 00	
No. 5561—To O. P. Egbert, supplies	14 30	
No. 5562—To Goldberg, Bowen & Co., supplies	15 52	
No. 6170—To John P. Dalton, salary and expenses	177 50	
No. 8271—To J. G. Woodbury, salary and expenses	156 96	
No. 12294—To John P. Dalton, salary and expenses	216 70	
No. 12295—To John P. Dalton, salary and expenses	159 85	
No. 12296—To John A. Richardson, salary	75 00	
No. 12297—To E. W. Hunt, salary	45 00	
No. 12298—To J. G. Woodbury, salary and expenses	241 83	
No. 12299—To J. G. Woodbury, salary and expenses	270 38	
No. 12300—To Osborn & Alexander, supplies	20 90	
No. 12301—To O. P. Egbert, supplies	7 15	
No. 12302—To W. H. Schnittger, salary	10 00	
No. 15455—To John P. Dalton, salary and expenses	208 00	
No. 15456—To John P. Dalton, salary and expenses	221 10	
No. 15777—To Osborn & Alexander, supplies	24 10	
No. 15778—To J. F. Curley, salary	25 00	
No. 16000—To Osborn & Alexander, supplies	21 45	
No. 16797—To R. Lauritzen, supplies	5 51	
No. 16798—To Osborn & Alexander, supplies	14 45	
No. 16799—To O. P. Egbert, supplies	25 15	
No. 16800—To Goldberg, Bowen & Co., supplies	32 15	
No. 17054—To James McKenna, salary	5 00	
No. 18249—To R. Lauritzen, supplies	11 30	
No. 18267—To Osborn & Alexander, supplies	14 10	
No. 18268—To Goldberg, Bowen & Co., supplies	24 60	
No. 18269—To O. P. Egbert, supplies	37 40	
No. 18270—To John P. Dalton, salary and expenses	126 55	
No. 1286—To O. P. Egbert, supplies (paid in 41st fiscal year)	23 53	
Totals	$3,881 32	$3,881 32

EXPENDITURES

During the Fortieth Fiscal Year, ending June 30, 1889, chargeable against the Appropriation for the Support and Maintenance of State Hatcheries.

Unexpended balance on hand July 1, 1888		$851 93
Warrants issued during the fortieth fiscal year, for services performed during the thirty-ninth fiscal year:		
Warrant No. 208—To J. Shebley, salary and expenses	$69 20	
No. 472—To W. H. Schnittger, salary and expenses	60 00	
No. 473—To Stevens & McKinny, supplies	200 00	
No. 1628—To J. C. Frazier, labor	93 34	
		422 54
Balance on hand from thirty-ninth year		$429 39
To appropriation (Statutes of California, 1887, page 215)		3,750 00
Warrant No. 1195—To Henry Woodson, supplies	$101 30	
No. 1197—To J. C. Frazier, salary	100 00	
No. 1196—To Stevens & McKinney, supplies	400 00	
No. 1629—To W. H. Shebley, expenses	63 35	
No. 1630—To J. Shebley, salary	93 00	
No. 3087—To W. H. Shebley, salary	81 30	
No. 3093—To John Hurley, rent	20 00	
No. 3094—To J. C. Frazier, salary	118 82	
No. 3095—To W. H. Schnittger, salary	60 00	
No. 5267—To J. G. Woodbury, salary and expenses	298 18	
No. 5533—To J. F. Wyman, supplies	8 12	
No. 5535—To J. C. Frazier, supplies	48 66	
No. 5534—To R. M. Watson, supplies	8 00	
No. 5558—To Sisson Lumber Company, supplies	364 71	
No. 5559—To Sisson, Crocker & Co., supplies	97 32	
No. 5560—To J. M. Bowles, Jr., supplies	42 50	
No. 6163—To J. G. Woodbury, salary and supplies	57 70	
No. 6164—To W. C. Gifford, labor	50 00	
No. 6165—To Whittier, Fuller & Co., supplies	13 00	
No. 6166—To J. H. Sisson, supplies	58 65	
No. 6167—To W. H. Schnittger, salary	5 00	
No. 6168—To Holbrook, Merrill & Stetson, supplies	17 51	
No. 6169—To Sisson Lumber Company, supplies	17 47	
No. 8895—To L. Stone, labor	375 00	
No. 8896—To Sisson, Crocker & Co., supplies	48 00	
No. 8897—To Fred. C. Boyce, labor	50 00	
No. 8898—To E. W. Hunt, salary	55 65	
No. 8899—To Mount Shasta Manufacturing Co., supplies	71 40	
No. 8900—To W. C. Gifford, labor	37 50	
No. 8901—To F. C. Boyce, labor	45 00	
No. 8902—To Robert Radcliff, freight	20 00	
No. 8903—To J. A. Richardson, traveling expenses	85 65	
No. 8904—To J. H. Sisson, supplies	41 30	
No. 8905—To J. C. Frazier, supplies	112 66	
No. 8906—To J. G. Woodbury, salary and supplies	169 41	
No. 12292—To Edson & Co., supplies	10 65	
No. 12293—To F. C. Boyce, labor	25 00	
No. 16783—To E. W. Hunt, labor	41 65	
No. 16784—To W. H. Schnittger, labor	10 00	
No. 17015—To J. G. Woodbury, salary and supplies	260 41	
No. 17053—To J. A. Richardson, salary and supplies	78 15	
No. 18250—To J. G. Woodbury, salary and supplies	465 33	
No. 18251—To W. H. Schnittger, salary and supplies	10 00	
Balance on hand July 1, 1889	36 04	
Totals	$4,179 39	$4,179 39

EXPENDITURES

During the Fortieth Fiscal Year, ending June 30, 1889, chargeable against the Fish Commission Fund.

By balance on hand, July 1, 1888	$2,253 82
Receipts into the fund, fortieth fiscal year	3,444 23

By Expenditures.

Warrant No. 206	To T. W. O'Neil, supplies	$240 90
No. 207	To L. L. Lewis, supplies	3 10
No. 474	To Carquinez Packing Company, supplies	12 50
No. 475	To John Ferrin, expenses	121 30
No. 476	To W. H. Ewing, labor	36 66
No. 477	To Stevens & Co., supplies	59 22
No. 478	To J. L. Sutton, salary	100 00
No. 479	To Bauer & Steffan, supplies	7 65
No. 480	To E. J. Upham & Co., supplies	6 83
No. 481	To G. A. Hastings, supplies	25 50
No. 482	To John S. Benn, traveling expenses	10 50
No. 483	To John F. Taggart, salary	50 00
No. 484	To Charles Josselyn, money advanced	38 62
No. 485	To J. J. Smith, labor	50 00
No. 486	To John P. Dalton, salary and expenses	305 75
No. 487	To James V. Geary, salary	110 66
No. 488	To J. L. Sutton, labor	50 00
No. 489	To John Ferrin, salary	209 79
No. 597	To T. J. Sherwood, expenses	98 70
No. 1032	To James Clyne, repairs	5 50
No. 1033	To C. D. Dagnol, rent of sloop	152 66
No. 1187	To J. Routier, traveling expenses	30 10
No. 2997	To L. L. Lewis, supplies	3 10
No. 2999	To Goldberg, Bowen & Co., supplies	9 80
No. 2998	To Mohr & Yoerk, supplies	4 95
No. 3000	To O. P. Egbert, supplies	11 75
No. 3001	To John P. Dalton, expenses	100 50
No. 3002	To Cooper's book store, supplies	8 50
No. 4590	To W. A. Duncombe, rent of sloop	41 57
No. 6162	To J. G. Woodbury, traveling expenses	208 91
No. 6550	To T. J. Sherwood, traveling expenses	251 15
No. 8891	To John P. Dalton, traveling expenses	151 95
No. 8892	To John P. Dalton, supplies	15 00
No. 8893	To Matt. Coffey, salary	35 00
No. 8894	To Joseph Routier, expenses	91 40
No. 11747	To Lauritzen & Frates, supplies	34 04
No. 15459	To J. G. Woodbury, salary and expenses	239 39
No. 15460	To J. G. Woodbury, salary and expenses	320 04
No. 15728	To E. W. Hunt, salary	45 00
No. 15729	To E. W. Hunt, salary	45 00
No. 15775	To J. A. Richardson, salary	75 00
No. 15776	To J. A. Richardson, salary	75 00
No. 16650	To Edward Reilly, salary	91 90
No. 16771	To T. W. O'Neil, painting	196 00
No. 16791	To C. Folger, salary	50 00
No. 16792	To M. J. O'Reilly, salary	1 50
No. 16793	To John P. Dalton, salary and expenses	368 10
No. 16794	To C. Elliott, salary	44 85
No. 16795	To G. J. Sculley, salary	41 50
No. 16796	To W. E. Elliot, salary	72 00
No. 17017	To M. J. O'Reilly, salary	60 00
No. 17055	To W. T. Robinson, expenses	37 00
No. 17056	To San Francisco "Daily Report," advertising	40 00
No. 18252	To M. J. O'Reilly, salary	30 00
No. 18253	To J. C. Frazier, salary	107 20
No. 18254	To John F. Moody, supplies	69 10
No. 18255	To C. C. Folger, salary	33 20
No. 18256	To G. J. Sculley, salary	50 00
No. 18257	To Truckee Lumber Company, supplies	113 16
No. 18258	To Carson and Tahoe Lumber Company, supplies	185 16
No. 18259	To J. G. Woodbury	110 00
No. 18260	To E. W. Hunt, salary, etc.	49 50
No. 18261	To C. Elliot, salary, etc.	50 00
No. 18262	To J. P. Dalton, salary, etc.	100 00
	Amounts carried forward	$5,393 16

Amounts brought forward	$5,393 16	$5,698 05
No. 18263—To Thomas H. Powers, salary, etc.	40 00	
No. 18264—To Westgate, Dozier & Co., supplies	27 34	
No. 18265—To W. E. Elliot, salary	68 00	
No. 18266—To Edward Reilly, salary	150 50	
Balance on hand July 1, 1889	19 05	
Totals	$5,698 05	$5,698 05

EXPENDITURES

During the Forty-first Fiscal Year, ending June 30, 1890, chargeable against the Appropriation for the Restoration and Preservation of Fish in the waters of the State.

To appropriation (Statutes of California, 1889, page 438) $5,000 00

By Expenditures.

Warrant No. 1280—To John P. Dalton, salary and supplies	$62 50	
No. 1284—To Frank Anaya, salary and expenses	77 50	
No. 1285—To M. J. O'Reilly, salary	2 00	
No. 1287—To Henry Mathey, expenses	122 10	
No. 2219—To Edward Reilly, salary and expenses	193 85	
No. 2478—To T. W. O'Neil, painting	70 00	
No. 2486—To M. J. O'Reilly, salary	30 00	
No. 2487—To R. Lauritzen, supplies	20 33	
No. 2488—To Osborn & Alexander, supplies	14 45	
No. 2489—To Goldberg, Bowen & Co., supplies	12 38	
No. 2490—To O. P. Egbert, supplies	37 05	
No. 2491—To John P. Dalton, supplies	67 34	
No. 2492—To John P. Dalton, salary	100 00	
No. 2493—To John P. Dalton, rent	10 00	
No. 2494—To G. J. Sculley, salary	50 00	
No. 2495—To W. Lamonte, salary	28 00	
No. 2496—To John Howard, salary	36 65	
No. 2497—To W. E. Elliott, salary	60 00	
No. 2498—To C. B. Elliott, salary	50 00	
No. 2499—To C. Higgins, salary	26 00	
No. 3375—To J. M. Sullivan, salary and expenses	172 44	
No. 3376—To J. M. Sullivan, salary and expenses	193 20	
No. 3377—To Edward Reilly, salary and expenses	203 20	
No. 3378—To J. W. Hughes, professional services	75 00	
No. 3379—To M. J. O'Reilly, salary	30 00	
No. 3380—To M. J. O'Reilly, expenses	5 75	
No. 3765—To John P. Dalton, salary	100 00	
No. 3766—To John P. Dalton, expenses	10 00	
No. 3767—To John P. Dalton, expenses	124 77	
No. 3874—To Frank Anaya, expenses	271 15	
No. 3875—To J. Downey Harvey, expenses	14 00	
No. 3876—To Joseph Routier, traveling expenses	108 65	
No. 3877—To O. P. Egbert, supplies	37 60	
No. 3878—To R. Lauritzen, supplies	17 80	
No. 3879—To Osborn & Alexander, supplies	14 45	
No. 3880—To W. Lamont, salary	40 00	
No. 3881—To W. Markham, salary	50 00	
No. 3882—To G. J. Sculley, salary	50 00	
No. 3883—To W. E. Elliot, salary	60 00	
No. 4997—To Jno. T. Curley, expenses	77 10	
No. 5048—To M. J. O'Reilly, salary and expenses	33 10	
No. 5138—To John P. Dalton, expenses	119 25	
No. 5139—To O. P. Egbert, supplies	24 25	
No. 5140—To Osborn & Alexander, supplies	14 45	
No. 5141—To J. Downey Harvey, expenses	5 00	
No. 5142—To W. Lamont, salary	40 00	
No. 5143—To H. H. Briggs, salary	100 00	
No. 5144—To G. J. Sculley, salary	50 00	
No. 5145—To A. Cassidy, supplies	46 66	
No. 5146—To W. Markham, salary	50 00	
No. 5147—To W. E. Elliott, salary	60 00	
No. 5148—To John P. Dalton, salary	100 00	
No. 5149—To J. F. Curley, salary	66 30	
Amounts carried forward	$3,434 27	$5,000 00

Amounts brought forward	$3,434 27	$5,000 00
No. 5150—To Joseph Routier, expenses	31 00	
No. 5151—To F. P. Callundan, salary and expenses	114 65	
No. 5126—To M. J. O'Reilly, expenses	11 45	
No. 6473—To J. M. Sullivan, expenses	108 05	
No. 6474—To E. Reilly, salary	100 00	
No. 6475—To E. Reilly, salary	152 05	
No. 6505—To M. J. O'Reilly, salary and expenses	32 20	
No. 6749—To J. Downey Harvey, expenses	5 00	
No. 6750—To Joseph Routier, expenses	147 35	
No. 6751—To C. H. Bogart, expenses	16 70	
No. 6752—To C. E. Grunsky, salary	11 10	
No. 6753—To F. Anaya, salary	62 80	
No. 6754—To F. P. Callundan, salary	100 00	
No. 6755—To H. F. Williams, salary	50 00	
No. 6756—To John F. Curley, expenses	109 60	
No. 6757—To James H. Carothers, expenses	10 00	
No. 6758—To John P. Dalton, expenses	24 41	
No. 7437—To C. W. Thorrold, salary	50 00	
No. 7438—To F. P. Callundan, salary and expenses	132 25	
No. 7439—To F. Anaya, salary and expenses	78 45	
No. 7930—To M. J. O'Reilly, salary and expenses	32 55	
No. 8354—To E. Reilly, salary	100 00	
No. 8407—To F. Anaya, salary and expenses	12 70	
No. 8408—To J. Downey Harvey, expenses	5 00	
No. 8409—To Joseph Routier, expenses	30 00	
No. 11314—To M. J. O'Reilly, salary	30 00	
No. 13169—Wells, Fargo & Co., expressage	6 15	
Balance on hand June 30, 1890	2 27	
Totals	$5,000 00	$5,000 00

EXPENDITURES

During the Forty-first Fiscal Year, ending June 30, 1890, chargeable against the Appropriation for the Support and Maintenance of State Hatcheries.

Unexpended balance on hand July 1, 1889		$36 04
Warrants issued during the forty-first fiscal year for services performed during the fortieth fiscal year:		
Warrant No. 1296—To W. H. Schnittger, labor	$5 00	
No. 1297—To Jones & Givens, supplies	30 75	
		35 75
Unexpended balance fortieth fiscal year		$0 29
By appropriation (Statutes of California, 1889, page 438)		5,000 00

By Expenditures.

Warrant No. 2500—To W. H. Schnittger, salary	$5 00	
No. 2501—To J. A. Richardson, salary and expenses	78 50	
No. 2502—To J. C. Frazier, salary and expenses	100 50	
No. 2503—To E. W. Hunt, salary and expenses	61 50	
No. 2504—To Truckee Lumber Co., supplies	33 00	
No. 2505—To Fireman's Fund Insurance Co., insurance	15 00	
No. 3884—To J. G. Woodbury, salary and expenses	357 12	
No. 3885—To J. G. Woodbury, salary and expenses	141 50	
No. 3886—To W. H. Schnittger, salary	5 00	
No. 3887—To J. C. Frazier, salary and expenses	50 50	
No. 3888—To E. W. Hunt, salary and expenses	63 50	
No. 3889—To J. A. Todman, labor	15 00	
No. 3890—To John Hurley, rent	20 00	
No. 5131—To Carson and Tahoe Lumber Co., supplies	73 51	
No. 5132—To Whittier, Fuller & Co., supplies	10 00	
No. 5133—To E. W. Hunt, salary and expenses	37 75	
No. 5134—To J. C. Frazier, salary	50 00	
No. 5135—To J. G. Woodbury, salary and expenses	205 35	
No. 5136—To A. J. Bayley, labor	21 50	
No. 5137—To Truckee Lumber Co., supplies	46 40	
No. 6759—To Wm. Boyle, labor	135 00	
No. 6760—To L. C. Nelson, supplies	15 00	
No. 6761—To E. W. Hunt, salary and expenses	79 15	
Amounts carried forward	$1,619 78	$5,000 29

Amounts brought forward	$1,619 78	$5,000 29
No. 6762—To Andrews & Barr, supplies	15 00	
No. 6763—To J. H. Sisson, supplies	31 10	
No. 6764—To J. G. Woodbury, salary and expenses	200 40	
No. 6765—To W. H. Schnittger, salary	10 00	
No. 6766—To Truckee Lumber Co., supplies	45 25	
No. 6767—To J. A. Richardson, salary and expenses	297 50	
No. 7931—To Liebenbaum Bros., supplies	38 95	
No. 7932—To J. M. Short, supplies	48 91	
No. 8405—To Sisson, Crocker & Co., supplies	43 61	
No. 8406—To W. H. Schnittger, salary	5 00	
No. 8410—To John F. Moody, supplies	46 66	
No. 9021—To Fireman's Fund Insurance Co., insurance	31 80	
No. 9022—To J. G. Woodbury, salary and expenses	152 25	
No. 9023—To Truckee Lumber Co., supplies	23 58	
No. 9024—To John F. Moody, supplies	88 42	
No. 9025—To J. A. Richardson, salary and expenses	163 90	
No. 9026—To J. C. Frazier, salary and expenses	66 33	
No. 9027—To E. W. Hunt, salary	75 00	
No. 9558—To Justinian Caire, supplies	49 01	
No. 9559—To W. F. Bowers & Co., supplies	10 00	
No. 9560—To W. H. Himes, supplies	6 00	
No. 9561—To L. C. Nelson, supplies	16 00	
No. 9562—To J. A. Richardson, salary	75 00	
No. 9563—To J. G. Woodbury, salary and expenses	144 60	
No. 9564—To E. W. Hunt, salary and expenses	78 00	
No. 10507—To J. A. Richardson, salary	75 00	
No. 10508—To J. G. Woodbury, salary and expenses	133 35	
No. 10509—To W. H. Schnittger, salary	5 00	
No. 10510—To L. Stone, salary and expenses	204 50	
No. 10659—To E. W. Hunt, salary	75 00	
No. 11575—To J. A. Richardson, salary	75 00	
No. 11576—To W. H. Schnittger, salary	5 00	
No. 11577—To J. G. Woodbury, salary and expenses	135 80	
No. 11578—To E. W. Hunt, salary	75 00	
No. 11579—To Sisson, Crocker & Co., supplies	95 91	
No. 11580—To The Bancroft Co., supplies	5 75	
No. 11581—To Southern Pacific Co., freight	22 85	
No. 11582—To Neville & Co., supplies	41 06	
No. 11583—To F. E. Drew, labor	25 00	
No. 12556—To E. W. Hunt, salary and expenses	92 90	
No. 12589—To J. G. Woodbury, salary and expenses	180 85	
No. 12590—To J. A. Richardson, salary and expenses	77 90	
No. 12591—To W. T. Bowers, expenses	5 50	
No. 12592—To Edson Brothers, supplies	61 50	
No. 12593—To W. H. Himes, labor	5 00	
No. 12594—To Leibenbaum Brothers, supplies	92 61	
No. 12595—To W. H. Schnittger, salary	10 00	
Balance on hand July 1, 1890	117 76	
Totals	$5,000 29	$5,000 29

EXPENDITURES

During the Forty-first Fiscal Year, ending June 30, 1890, chargeable against the Fish Commission Fund.

By balance on hand July 1, 1889	$19 05
Receipts into the fund, forty-first fiscal year	5,309 17

By Expenditures.

Warrant No. 1272—To W. E. Elliott, salary	$60 00	
No. 1273—To John Howard, salary	50 00	
No. 1274—To G. J. Sculley, salary	50 00	
No. 1275—To Thomas H. Powers, salary	40 00	
No. 1276—To John P. Dalton, salary	100 00	
No. 1277—To John P. Dalton, expenses	71 91	
No. 1278—To Charles Elliott, salary	50 00	
No. 1279—To John F. Moody, salary	20 00	
No. 1283—To Frank Anaya, salary	23 10	
Amounts carried forward	$465 01	$5,328 22

Amounts brought forward	$465 01	$5,328 22
No. 1288—To E. W. Hunt, supplies and salary	73 25	
No. 1289—To J. A. Richardson, salary	45 70	
No. 1290—To E. Reilly, salary	153 00	
No. 1291—To M. J. O'Reilly, salary	30 00	
No. 1292—To R. Lauritzen, supplies	13 65	
No. 1293—To Osborn & Alexander, supplies	14 45	
No. 1294—To Goldberg, Bowen & Co., supplies	14 00	
No. 1295—To J. C. Frazier, salary and supplies	104 50	
No. 2716—To J. G. Woodbury, salary and supplies	609 72	
No. 2965—To J. Downey Harvey, traveling expenses	192 00	
No. 4452—To C. Higgins, labor	95 00	
No. 5826—To J. Downey Harvey, traveling expenses	413 00	
No. 6768—To H. G. Miller, balance due on contract	16 40	
No. 6769—To "Sacramento Bee," advertising	24 00	
No. 7208—To John P. Dalton, supplies	5 25	
No. 7209—To John F. Moody, expenses	42 45	
No. 7210—To R. Radcliff, expenses	100 00	
No. 8369—To H. Dutard, rent of tug	49 50	
No. 8370—To F. P. Callundan, salary and expenses	207 25	
No. 9154—To E. Reilly, salary	100 00	
No. 9158—To M. J. O'Reilly, salary and expenses	31 40	
No. 9520—To Joseph Routier, traveling expenses	5 00	
No. 9521—To J. Downey Harvey, traveling expenses	5 00	
No. 9522—To F. P. Callundan, salary and expenses	199 50	
No. 9523—To Thomas Tumstead, salary	100 00	
No. 9524—To W. J. McDowell, expenses	16 80	
No. 9525—To J. F. Curley, expenses	7 25	
No. 9526—To J. F. Curley, expenses	28 50	
No. 10501—To F. P. Callundan, salary and expenses	199 00	
No. 10502—To J. D. Ennis, salary	100 00	
No. 10503—To M. J. O'Reilly, salary and expenses	33 85	
No. 11617—To Joseph Routier, traveling expenses	34 00	
No. 11618—To Joseph Routier, traveling expenses	30 00	
No. 11619—To J. D. Harvey, traveling expenses	5 00	
No. 11620—To J. D. Harvey, traveling expenses	5 00	
No. 11621—To F. P. Callundan, salary and expenses	130 50	
No. 11622—To Whittier, Fuller & Co., supplies	8 00	
No. 11623—To John D. Ennis, salary	100 00	
No. 12553—To Joseph Routier, traveling expenses	30 00	
No. 12554—To F. P. Callundan, salary and expenses	201 70	
No. 12555—To M. J. O'Reilly, salary and expenses	31 90	
No. 12599—To J. D. Harvey, traveling expenses	5 00	
No. 12600—To John M. Bailhache, expenses	6 00	
No. 12601—To John D. Ennis, salary	100 00	
No. 13184—To T. E. Sullivan, labor	22 50	
No. 13185—To W. H. Shebley, salary	52 25	
No. 13400—To M. J. O'Reilly, salary	30 00	
No. 13401—To E. D. Stewart, labor	68 55	
No. 13402—To S. F. Earl, labor	97 50	
No. 13403—To John D. Ennis, salary	130 50	
No. 13404—To John F. Curley, boat hire	30 00	
No. 13405—To J. Downey Harvey, traveling expenses	5 00	
No. 13406—To F. P. Callundan, salary and expenses	121 40	
No. 13407—To Joseph Routier, traveling expenses	30 00	
No. 13869—To T. W. O'Neil, labor	177 80	
No. 13885—To M. J. O'Reilly, salary	30 00	
No. 13886—To E. W. Hunt, salary and expenses	107 35	
No. 14045—To Joseph Routier, traveling expenses	30 00	
No. 14092—To John D. Ennis, salary and expenses	121 50	
No. 14093—To F. P. Callundan, salary and expenses	137 45	
Balance on hand July 1, 1890	44 89	
Totals	$5,328 22	$5,328 22

EXPENDITURES

During the Forty-first Fiscal Year, ending June 30, 1890, Chargeable Against the Appropriation for the Importation and Propagation of Game Birds.

To appropriation (Statutes of California, 1889, page 304)		$2,000 00
By Expenditures.		
Warrant No. 8404—To "American Field" Publishing Company, advertising	$3 84	
No. 11313—To State Board of Fish Commissioners	500 00	
Balance on hand July 1, 1890	1,496 16	
Total	$2,000 00	$2,000 00

REPORT OF J. G. WOODBURY,

Superintendent of Hatcheries and the Restoration of Fishes, embracing the Operations carried out during the period between August 1, 1888, and October 1, 1890.

San Francisco, October 1, 1890.

To the honorable the Board of Fish Commissioners of the State of California:

Gentlemen: After being appointed Superintendent by your honorable Board on the first day of August, 1888, I visited Lake Tahoe, where Mr. Frazier was in charge of hatching the six hundred thousand eyed trout eggs, which had been contracted for by your honorable Board.

These eggs were being hatched in a rented building, small and windowless, and consequently giving insufficient light to distinctly observe the condition of the fish in the troughs, which is a very essential matter, for cleanliness is a cardinal virtue in the successful hatching and rearing of trout, and an abundance of light is necessary to perceive what one is doing.

The supply of water to the hatchery on a hot day was very precarious, diminishing in quantity in the middle of the day, and with cattle tramping up the ground around the springs, and the rotten condition of the wooden pipes which conveyed the water a long way to the hatchery, made it a very uncertain business in hatching trout, and kept the attendant in constant apprehension of some mishap.

It seemed a reproach to the California Fish Commission to be compelled to do its work of stocking Lakes Tahoe, Donner, Independence, Webber, and the mountain streams in the vicinity with fish under such adverse conditions as these. And if it is thought of sufficient importance that these waters be stocked with trout, it should be done from year to year, continuously, for intermittent work of this kind—stocking these waters for a year or two and then skipping a year—is work almost thrown away.

It occurred to me that the State should select some favorable point for shipping, and build its own hatchery, commodious and well appointed, with a certainty of plenty of cold spring water, and make Lake Tahoe a trout-hatching station as a distributing point for all these mountain waters.

Mr. Frazier reported that he shipped the trout, resulting from these six hundred thousand eggs, in 1888, to the localities and in the numbers given in the tables which accompany my report to your honorable Board.

THE SISSON SALMON HATCHERY, 1888.

The Board of Fish Commissioners had received word from Mr. Livingston Stone, who was in charge of the United States salmon hatchery on the McCloud River, that he would deliver at the McCloud River Station, free of charge to the California Fish Commission, four million eyed salmon eggs for stocking streams in this State.

To take advantage of this generous offer on the part of the United States Fish Commission, I immediately, on my return from Lake Tahoe, started to look up a place on the headwaters of the Sacramento River for the erection of an extensive hatchery to accommodate this large number of eggs when hatched out. The necessary conditions for hatching out so many eggs, and the large trough space for nurseries to keep in good condition the young fish until they are old enough to ship, are a good sized stream of pure, cold spring water with no possibility of floods washing out the ditches or flumes that take the water to the hatchery, and with a right at all times to control a sufficient quantity of water for all purposes. It was also essential that the hatchery should be at a convenient distance from the railroad station and a telegraph office for convenience of shipping the fish to distant points; also, a point on the river, whence it was, owing to its accessibility, the cheapest to reach by wagon road the greatest number of the branches of the headwaters of the Sacramento River. For the shipping of even one million of young fish to distant points and properly distributing them over the nursery grounds is a costly and tedious operation.

After examining the Sacramento River for the best place in my opinion, I selected, with the consent of Mr. J. H. Sisson, a site in the field back of his barn about three quarters of a mile from the railroad station in the town of Sisson. The spot selected is well drained, sunny, and sheltered from the prevailing winds, and with an open view of old Mount Shasta.

The water for the hatchery comes from a large spring, about one and a half miles distant, which forms the extreme head of one of the branches of the Sacramento River. Its volume is sufficient to run a sawmill, and its temperature is 46 degrees Fahrenheit at all seasons. The main ditch from this spring runs near by the hatchery. It seemed to be an ideal place for a hatchery, and also most conveniently situated for distributing the fish to the proper nursing grounds. In the two years of experience since the hatcher was built, in hatching the millions of trout and salmon eggs, the expectations have been more than fulfilled. The waters seem to have a marvelous virtue in maintaining the health of the young fish as well as having a sparkling taste to the palate. The hatchery was built in expeditious haste to prepare it in one month for the reception of the expected salmon eggs from the September run of fish at the McCloud River Hatchery.

The hatchery is a plain building forty feet by sixty feet, strongly built, with a half pitch roof which has resisted the tremendous snows of the past winter. It has a capacity for forty-four hatching troughs sixteen feet long and sixteen inches wide. The troughs are made of one and one half-inch dressed pine, and are painted with three coats of asphalt varnish to prevent the wood from growing a fungus, which would destroy the young fish. A head trough sixteen inches square, prepared in the same way, runs the entire length of the building, sixty feet, which furnishes water through gates to the hatching troughs. A large filtering tank outside, and a flume about one hundred yards long, connect the hatchery with the main ditch. The hatchery has a system of troughs beneath the floor to carry off the water from all the hatching troughs to a waste ditch outside.

A room fourteen by sixteen feet, for the men to live in, was finished in the upper part of the hatchery.

SALMON HATCHERY AT SISSON, CAL.

Interior of Hatchery at Sisson.

Trout Hatchery at Lake Tahoe, Cal.

Interior of Hatchery at Lake Tahoe.

Each trough has screens and covers to protect the eggs from the light. One hundred and fifty wire hatching baskets were made and painted with asphalt varnish. It seemed to be an endless task to get this large hatchery finished. We worked every day in the week, and most of the nights until ten and eleven o'clock, painting the troughs, making the baskets, covers, etc., and fixing up the living-room. This work continued long after the first lot of eggs were received.

This hatchery is well equipped and is also one of the largest in the country. It has a third larger capacity than the United States Salmon Hatchery on the McCloud River, where fourteen million salmon eggs have been eyed at one time.

Before shipping the eggs, Mr. George B. Williams, Superintendent of the station at Baird, where the United States Salmon Hatchery is located, sent word notifying us of the date of shipment. The salmon eggs are hauled to Smithson, on the Sacramento River, where one of our men meets them with ice to be put in the packages to keep them cool. The State Fish Commission pays all expenses incurred on the shipment of eggs from the McCloud River to Sisson. The United States Fish Commission generously donates the eggs, eyed and packed, ready for shipment, from the Government Hatchery on the McCloud River.

We received at the Sisson Hatchery, from the September run, 1888, about eight hundred thousand salmon eggs, instead of the three or four million which were expected to be taken during that month. This caused a great surprise and disappointment, for ten years ago during the same month twelve million eggs were easily taken. This shows what havoc the fishermen with their nets are making in the lower Sacramento River.

This year, 1888, the United States Fish Commission renewed their operations on the McCloud River, that station having been abandoned during the previous five years. The eight hundred thousand eggs received from them were hatched out at Sisson, and kept till old enough to be planted, and during the month of December were distributed in branches of the Sacramento River, the West Fork, Salloway Creek, Big Spring Creek, Cold Creek, and in the main Sacramento below the eighteenth crossing.

The Government Station on the McCloud River did so poorly in the August and September run that they continued their efforts for the taking of more spawn during October and November. This had been unusual in former years, because they got all they required in the first run. Usually the McCloud River rises in volume during the fall rains, which makes it very difficult for the men to keep their traps in the river (as, for instance, during last year, 1889, when everything was swept away).

We received at the Sisson Hatchery from the October and November run, 1888, about two million two hundred thousand salmon eggs. The eggs arrived during the last of December and part of January, 1889. These were hatched out in fine condition, and kept till old enough to ship, and were distributed, in March and April, in the same streams as those of the September run; and, also, down the Sacramento River as far as Big Castle Creek. In shipping these fish down the river the Southern Pacific Railroad Company very generously loaned us the use of a hand car, and gave the right of way on their road. Without this accommodation it would have been almost impossible to have distributed the fish properly. With the good water at the Sisson Hatchery,

and the care they received from the attendants, Mr. James A. Richardson and Mr. E. W. Hunt, I venture to say that no fish were ever hatched out with a less percentage of loss.

In the fall of 1888 a contract was made with Mr. Livingston Stone, at the United States Hatchery on the McCloud River, to hatch out from the eyed eggs which the United States Fish Commission donated to the California Fish Commission, five hundred thousand young salmon at 75 cents per thousand, and distribute them in the McCloud River.

The United States Fish Commission also very generously hatched out and planted in the McCloud River the same season one million young salmon at its own expense; and, also, in 1889 the United States Commission planted eighty-four thousand young salmon in the McCloud River. More would have been planted there that year by the United States Commission, if the floods had not washed out the traps and thus prevented the taking of any more breeding salmon.

Mr. J. H. Sisson generously gave two lots in the addition to the town of Sisson, each thirty feet by one hundred and forty feet, for the use of the hatchery, for $1 a year with the free use of the water; and, also, he signed a bond to give the Fish Commission permission to remove the buildings, or else buy the land at the market price, with a perpetual free use of all the water from Big Springs Creek which the hatchery should need. These lots should belong to the Fish Commission, with one or two more of the adjoining lots on the south included.

Mr. Dunn, the Controller, claims that under the present law the Fish Commission has no right to purchase land for its hatcheries. I would suggest that your honorable Board petition the next Legislature for a law to be passed granting the Fish Commission the right to purchase land for its hatcheries when a desirable locality has been fixed upon.

If the hatcheries do any good in maintaining the normal supply of food fish by restocking the streams, and if it is advisable to operate the hatcheries for a few years, it is equally important to maintain them for all time. The State consequently should own and operate its own hatcheries as a permanent institution.

As soon as the young salmon were all distributed (April, 1889), the hatchery was closed at Sisson for the season of 1888–9.

LAKE TAHOE.

Operations were now immediately begun at Lake Tahoe. The fishermen said that the month of May was too late a date on which to take spawn at Taylor Creek, which was considered the best place for getting the most spawn. But we managed by careful seining to get about one hundred and fifty thousand trout eggs here, which were put into the old private hatchery at Tahoe City. Taylor Creek is at the upper end of the lake, about twenty miles from the hatchery. Work was then begun on traps to be put in the creeks near their mouths. We had to wait for the lumber to be sawed out at Truckee and hauled over what was, at that time, a bad road. This delayed us somewhat, but as soon as possible we had traps in Meek's, Phipps', Blackwood, and Ward Creeks. Trout run up these creeks later than they do in Taylor Creek, for the reason that these streams are fed by melting snow water which is cold and often roily, while Taylor Creek has its source in Fallen Leaf Lake, which modifies the temperature of the small streams running into it.

In Meek's Creek the trout had been running some time before we put in our traps, and Chinamen had been catching them by torchlight, so the fishermen said. The run dwindled down very fast and we caught but few trout, but the traps were full of suckers.

In Phipps' Creek, which is later than Meek's, the trout had not begun to run when the traps were set; the water was very low. We caught here but very few fish during the season. Trout used to run up this stream in large numbers, but a trap had been kept here for years past to catch the fish, principally for the market, and I could not learn if any young trout had been planted in the stream to restock it in place of those which had been prevented from going up to spawn.

The next creek, Blackwood, is a larger and later stream for trout; in this creek we caught the greater bulk of our eggs. We had to continue trapping in this creek a long time—into August, in fact—when the water became very low.

In Ward Creek but very few trout were caught.

We also seined at the Incline in Nevada, by permission of Fish Commissioner Mills. Here formerly trout used to be caught in great numbers by the same fishermen who worked this season for us. This year, however, but few fish could be seined, while cart loads of sawdust were drawn in by the seine. The two streams which empty into the lake at this place were very low.

We took this season, 1889, about one million two hundred thousand eggs. It was expensive to keep the traps in for so long a time with men to attend them. Spawn taking had been continued through three months, while in an ordinary season, and to get two million five hundred thousand eggs, it was expected that the work of spawning would be done in six weeks. The cause given why so few fish could be caught was that it had been an open winter around the lake, scarcely any snow had fallen, and the water consequently in all the streams was very low. It is the melting of the deep snows in the mountains that cause the streams around Lake Tahoe to rise in April, May, and June. All the traps and seining grounds were at distant points from the hatchery. The eggs had to be brought around the lake on the steamer or in rowboats.

In the first part of this report mention is made of the old private hatchery, where the Commission was having trout hatched, of its inadequate qualities, of the insufficiency of water for hatching purposes, and the insecurity of supplying pipes. It seemed necessary that the Fish Commission of this State should have a hatchery of its own, sufficiently large to take care of fifteen hundred thousand trout, with a good supply of cold spring water.

A State hatchery at Lake Tahoe would be the most central, as a point of distribution, for the great Tahoe, Donner, Independence, and Webber Lakes, as well as the Truckee River and its branches, and also the headwaters of the different forks of the American River, and rivers farther south, rising at the summit of the Sierra Nevada Mountains—these latter being stocked with Eastern trout alone, while all the former could be stocked with Lake Tahoe trout, Eastern trout, and the land-locked salmon.

Lake Tahoe is of considerable importance as a resort for health and pleasure by tourists from the East, as well as large numbers of our own people. Boating and fishing are among its pastimes. Travel here must increase as our State becomes more thickly populated. All these waters

were well stocked with trout in former years, when the Truckee River was open to the passage of trout from Tahoe to Pyramid and Echo Lakes. The magnificent spawning grounds of the whole length of the Truckee River were then used by the trout to deposit their eggs. In almost countless numbers the trout made their way from Pyramid and Echo Lakes to Lake Tahoe. But since the dams have been built on this river no trout can get up to Lake Tahoe, and of late years trout have been diminishing above the lower dam very fast.

Taking all these things into consideration, I thought it best to build at Lake Tahoe a new State hatchery.

THE NEW STATE HATCHERY AT LAKE TAHOE.

Soon after arriving at the lake, and while the other work of seining and trapping was in operation, I began to look up a place to build, with the necessary conveniences for hatching and shipping. A spot near Tahoe City was selected, where there were some fine springs near the shore of the lake and quite close to the steamer landing.

No one could tell me where the owner could be found, or even what his name was. But in the hurry for a safe place to hatch the spawn which was being taken (the first few lots were placed to the old private hatchery, which was hired for the purpose), I had determined to build a temporary hatchery on the place selected, and trust to luck in finding its owner and buying it of him. So I ordered lumber from the mill at Glenbrook for the building, and had the hatching troughs made at the factory in Truckee. Wire for the hatching baskets was ordered from San Francisco. A man was put to work getting out sills for the foundation of the permanent hatchery. Other men were set to digging ditches to bring in water from the springs to a new reservoir to be made near the lake shore. As soon as the lumber and troughs arrived, a temporary roof was put up. Some of the troughs were painted and prepared for the eggs. After the troughs were in place, and the flume to the head trough finished, and the water was running in the hatching troughs, we brought the eggs from the old hatchery to our temporary new one. We felt much relieved now, for we could take care of the eggs as fast as they came in, and had the eggs which were in the old hatchery in a safe place—the old rotten pipe had already burst several times, and we had been harassed with fear of losing the eggs.

At this point of our work I started for San Francisco to find the owner of the place on which I wished to build the new hatchery. After considerable trouble and delay, I found the owner of the springs, and after making a bargain at a fair price for the land, and a guarantee to give me a month to search the title, I returned to Tahoe. We at once began work on the new hatchery, laying a strong foundation with heavy sills to bear up the weight of water and heavy winter snows.

The building is twenty-four feet by forty-two feet, strongly built, with a half pitch roof. It has seventeen windows, which give abundance of light. The plan of the hatching troughs is like those at the Sisson Hatchery, with twenty-four troughs twelve feet long, and sixteen inches wide—with head trough and a large settling tank outside connecting with a flume, which brings the water down for about two hundred yards from the springs.

As soon as the building was ready and part of the troughs had been

placed in position, we transferred the baskets of eggs and young fish from the temporary hatchery to the new building; the remaining troughs were then put in place.

The troughs are well made, of sugar pine, and painted with two coats of asphalt varnish. A good supply of new hatching baskets, painted with varnish, and covers made for all the troughs.

The hatchery is well appointed, strongly built, and roomy.

It was necessary to do all this work as quickly as possible, and, in doing it, there were many vexatious delays. No supplies for the work could be obtained at Tahoe, except lumber in the tree. The shakes for the roof had to be made, the sills had to be hewn from the tree, and, as no teams get in there until the loggers arrive, we were much delayed in hauling the sills and shakes. The lumber had to be sawed and brought over on scows from Glenbrook, then rafted and got inshore as close as possible, then thrown into the water, pushed ashore, dragged out and packed up to the building.

Lake Tahoe is a very difficult place to collect spawn. The traps are all at distant points. In going to one on the steamer it takes all the next day to get back, as the steamer has to go round the lake to get home. To go to the traps off the regular route of the steamer rowboats must be used, which takes half a day to go the round trip. On many days the lake is so rough that it is not possible to go in a boat. We had a very busy summer's work; all hands were employed every Sunday, as well as through the week days.

Of the thirteen acres which were bought for the hatchery, the greater part consisted of wet land through which the springs flowed. This naturally produced the best feeding ground for cows. As soon as the grass began to spring up, about two hundred head of cattle were driven into the neighborhood of Tahoe City, and they made our springs their headquarters. They would wade in all through that soft ground among the alders, tramping it up, and the water in the hatchery would be black with mud, covering the eggs and thickly settling on the bottom of the troughs.

We had to endure this annoyance for weeks, leaving our work in the day time to drive them off, and watching the place till ten o'clock at night, till the wire for fencing ordered from Sacramento arrived, the posts split, the holes dug, and fence put up to protect ourselves from their raids.

Later in the season, when most of the fish were shipped and more leisure obtained, a line ditch was dug from the reservoir to the main spring, and a strong flume of two-inch planks was laid and covered up. This was to keep the water from getting heated upon a hot day. Also, a new house for quarters for the men was built, sixteen feet by twenty-four feet, with three rooms, boarded and battened outside and close boarded inside, making a strong, well built, and warm house. A new stove and housekeeping articles were bought. Our men did their own cooking after the first of August, the Commission furnishing the supplies, thus saving large board bills at the hotel.

After I had made a bargain for the land, your honorable Board sent me word that Mr. Dunn, the Controller, said that he had no authority to issue a warrant to pay for land for the Fish Commission. As the buildings were already begun, and as there was no other course to pursue but go ahead, I wrote your honorable Board that I would buy the land myself and rent it to the Commission at a nominal sum.

After the spawn was all taken, about the first of August, I sent Mr. Richardson to the city to begin shipping Black bass from the Spring Valley Water Company's lakes.

Mr. Hunt stopped at the hatchery till most of the young trout were shipped in the latter part of September. He then went to the Sisson Hatchery to receive the first lot of salmon eggs from the United States Hatchery on the McCloud River. I had already been up there (August), and painted the troughs with asphalt varnish, and turned on the water to soak them in readiness for the September run of salmon eggs.

I stopped at the Tahoe Hatchery, working on the house and flume most of the time until both were finished.

The fish being all shipped, the house and flume finished, several cords of wood got into the house for the next spring work, the hatchery was closed up on the last of October, 1889.

The distribution of this season's trout (1889) at Lake Tahoe will be seen on reference to the tables.

BLACK BASS.

Seth Green brought the first Black bass to California. These were brought out at the expense of a sportsmen's club, and placed in Temescal Lake, near Oakland. A few waters have been stocked from the young of these bass.

The second lot of Black bass was brought out by B. B. Redding, for the California Fish Commission, and planted in the Crystal Springs reservoir, near San Mateo, with the permission of the Spring Valley Water Company, for breeding purposes, with the privilege of shipping the progeny of these fish to stock the waters of this State.

The Black bass is a splendid game fish, fighting bravely and fiercely for its liberty, many anglers claiming that there is more sport fishing for them than for trout. They are also a delicious fish to eat. They will do well in almost any of our fresh waters, either rivers or lakes; they multiply very rapidly, and require no aid from artificial propagation. When waters are once stocked with them, they are to stay, if fair play is shown them. They should be protected for several years till the original stock has had a chance to breed two or three times, and afterwards no fishing should be allowed for several months during the spawning season. Like any other live stock, if breeders enough are not reserved, the stock will become diminished.

The Black bass, like Striped bass are ravenous feeders; they will devour the Sticklebacks, which almost all fish avoid on account of their spines.

Not many of our public waters have been as yet stocked with these fish. They should be, for when once they become stocked with Black bass it is done for all time.

Clear Lake, in Lake County, will make, when it has been well stocked with Black bass, a splendid and extensive resort for anglers. There is an inferior fish there which breeds in myriads, which will give grand feasting for Black bass.

It was thought to be high time that some systematic work should begin to stock all the waters of our State that are proper to plant with bass: Clear Lake, the Blue Lakes, Tulare Lake, Goose Lake, and many smaller lakes in our State, and perhaps the great Klamath Lakes. Probably it

would not be well to plant Black bass in Tahoe, Donner, Independence, or Webber Lakes.

The rivers Kern, King, and so forth, are admirably adapted for the home of this fish. I am not over confident that it would be safe for the young salmon to have the Black bass planted in either the Sacramento or San Joaquin Rivers.

The young salmon make the Sacramento River their highway from the nursery grounds in the McCloud and upper Sacramento Rivers to the ocean, and they would have to run the gauntlet of the Black bass if the latter were planted there. But the perch and the Sacramento River pike, which have always been there, would also be salmon eaters, if they could catch them. The question remains: Would the Black bass be any more destructive than their first cousin, the perch? At any rate, in time these fish will find their way into these rivers, clandestinely by private parties, if not done so openly by the Fish Commission. Russian River is, I understand, at present well stocked with Black bass.

Many applications have been made for Black bass to stock waters in different parts of the State. They have to be caught for shipment with hook and line. If they swallow the hook it is liable to injure them, and cause them to die while kept in confinement waiting for shipment, or on the journey to be planted.

When fish are shipped to private waters, the expenses of the journey, transportation, railroad fares, hotel bills, etc., are expected to be paid by those who make application for them. Fifty fish, such as would breed for the first time during the following spring, are sufficient to stock any reservoir or small lake. The number did not exceed twenty which were originally placed in Crystal Springs reservoir.

Mr. James A. Richardson, after leaving the Tahoe Hatchery, in August, 1889, began shipping the Black bass, making one trip to the waters near Oroville, for Senator Jones, one to Sweetwater reservoir, San Diego, and two shipments to Clear Lake. More shipments would have been made that year, but Mr. Richardson became seriously ill, and had to postpone the work.

SISSON HATCHERY, 1889-90.

The salmon hatching season opens about the latter part of September. Mr. E. W. Hunt, after leaving the Tahoe Hatchery, in September, 1889, went up to the Sisson Hatchery to receive the first consignment of salmon eggs from the United States Hatchery on the McCloud River. There were shipped of the August and September run nine hundred and seventy-four thousand salmon eggs, and of the later run in October and November, three hundred and fifty-five thousand salmon eggs. In all, for 1889 only one million three hundred and twenty-nine thousand eggs.

The reason why this small number of eggs (three hundred and fifty-five thousand) was received in the second run from the United States Hatchery, was because of the heavy early fall rains, which raised so great a flood in the McCloud River that it swept out all their traps, and put an end to all fishing for that season. This shows how important it is that the close season for salmon should be so definitely fixed that sufficient numbers of breeding salmon should reach the United States Hatchery in the month of September, so that a sufficient supply of eggs for artificial hatching could be caught at that time to supply the young for stocking the rivers of our State, and not depend upon the late fall

run, which is so uncertain on account of the liability to floods, which makes it impossible to secure the salmon.

The young fish from the first run of salmon eggs were compelled to be kept, on account of the furious snowstorms of the past winter, till in February and March, of 1890, and then distributed, the boys using snow-shoes and hauling them out on handsleds. The second run was kept till March and April, and was distributed, same as the first lot, in the Sacramento River and its branches. Many difficulties had to be encountered this year, owing to the great snowstorm. For weeks there was almost continuous shoveling of snow, to keep it away from the windows of the hatchery, to obtain some light to enable the attendants to see to do their work.

The young fish had to be put on short rations during the great snow blockade, on account of the scarcity of meat.

EASTERN BROOK TROUT.

The Eastern Brook trout, with its brilliant scarlet spots, mottled green back and lower fins red and fringed with white, is one of the most beautiful fish in the world. It is gamey and has a delicate flavor.

Our first Board of Fish Commissioners thought they would be a valuable acquisition to our trout streams. They introduced the eggs of these fish from New Hampshire in 1876; these were hatched out and distributed from their first hatchery on the University grounds at Berkeley. They continued the introduction and hatching of these fish for several years. The fish were distributed in many hundreds of thousands into the streams of Alameda, Marin, San Mateo, Santa Cruz, Santa Clara, and Monterey Counties; also, in the high Sierra Mountains, above the falls of the Yosemite Valley, on the headwaters of the Yuba and North Fork of the American River, Prosser Creek, a branch of the Truckee River; also, in Cold Creek, at Sisson, a small branch of the headwaters of the Sacramento River. In all these short coast streams, which become warmer and diminished in volume as the summer advances, they have not reproduced themselves—at least, I cannot learn that any have been caught for a number of years past; but in all the high Sierra streams where these trout were planted, they can now be caught quite plentifully. The integrity of their characteristics in all their virgin beauty is maintained. A number of these fish were caught during the past summer in Blackwood Creek, Lake Tahoe.

About four years ago a few of these fish were planted in a small lake on the mountain side back of McKinney's place, Lake Tahoe. Last year Mr. McKinney told me that a number of Eastern trout had been caught in that little lake, one of which weighed three pounds. He said they were fierce fighters, and had a delicious flavor. Some of these Eastern trout have been caught thirty miles down the river from the place where they were first planted in the North Fork of the American River. It seems to me very probable that the Eastern Brook trout, as they become older and larger, will drop farther and farther down the main stream and ascend other branches to spawn, and, thus becoming acclimated, will gradually stock all the streams in the State accessible from the first stream in which they were planted. From the Tahoe Hatchery, Lake Tahoe: Fallen Leaf Lake and the streams which empty into these lakes, the numerous small lakes on the mountain sides, the

Middle and South Forks of the American River, as well as the headwaters of other rivers farther south; also, the North Yuba and Feather Rivers could be stocked with these Eastern Brook trout.

From the Sisson Hatchery, these trout could be planted in the headwaters and branches of the Upper Sacramento and McCloud Rivers, and also in the headwaters of the Trinity and Klamath Rivers.

It seemed to me to be such a public good that these trout should be systematically planted in all these mountain streams, so that anglers could catch these speckled beauties during their vacations for health and pleasure, that I asked of your honorable Board permission to buy one hundred thousand Eastern Brook trout eggs. They were shipped from Mr. Livingston Stone's trout hatchery, Charleston, N. H. These eggs were hatched out during the past winter at the Sisson Hatchery. From these eggs, which came about four thousand miles, we got about eighty thousand of fine, healthy trout; these were kept in the hatchery for several months waiting for the snow to melt so that the roads could be opened to the McCloud River and other places. As soon as these fish could be shipped, about thirty thousand were planted in spring brooks which feed the upper McCloud River, near the Horseshoe Bend at the eastern side of Mount Shasta. Twelve thousand were planted on the application of Senator Stanford in Deer Creek, a fine stream which rises in the Sierra Nevada Mountains and empties into the Sacramento River, near Vina. The balance of the trout were planted in the West Fork of the Sacramento River, and also in School House Spring and Kaiser's Creek, branches of the upper Sacramento River; also, in the headwaters of the Shasta River, Griffin's Springs, Wadsworth Springs, Big Springs, and in Shovel Creek, branches of the Klamath River. The Eastern Brook trout cannot but do well in all of these places, as there is plenty of food and the water is cold. I consider that it is worth all the expense and trouble many times over to have the famous McCloud River stocked with these fine fish. In order to get these waters well and permanentely stocked with these fish, several years of continuous stocking should be done.

TROUT HATCHING AT SHOVEL CREEK, 1890.

There had been complaints because no trout had been planted in the vicinity of the bay of San Francisco during 1889, but as a food fish was of the first consideration, a hatchery large enough to accommodate the donation of salmon eggs from the United States Government had to be erected. The Tahoe Hatchery was built during the next spring and summer, and the season's work carried on there. This work was all done in hot haste, and, with shipping the Black bass, we had no time to spare. Our help was all engaged and the money getting short.

To ship trout from Tahoe to streams around the bay would take at least four days' time, and the trip is very expensive, nearly $100 a trip.

These two large hatcheries, with appointments and quarters for the men, with the large number of salmon and trout distributed, were paid for solely from the regular appropriation.

To meet the wants of the anglers in having the streams stocked with trout, I began to prospect early in the winter of 1889 for a station where the Rainbow trout could be caught in sufficient numbers to make it an object to build a small hatchery, eye their eggs and then ship these eggs

to the Sisson Hatchery, hatch them out and from there ship the young fish to stock the streams of the State as well as possible.

The Shasta River, in Siskiyou County, had been famous for its great numbers of trout. I looked at that and made close inquiries, and found that but few trout run up that stream now in comparison to the great numbers that formerly did so. And no wonder, for the water has been taken out of that river for years, and from the famous springs which help to supply its volume of water, through open irrigating ditches, with no screens to keep the trout from being drawn in and distributed through the grass to die. A gentleman, who formerly owned a farm near Edgewood, told me that he had found fully thirty thousand dead young trout, which he discovered in holes after the water in his ditch had been turned off. This number is one instance. Now, taking the same ditch through the whole season and adding this to the other ditches in Shasta River Valley, and the numbers of trout destroyed in this way would amount up into the millions.

I also heard of the Shovel Creek, at the Klamath Hot Springs, as a wonderful trout stream. I visited that place, and received the generous permission of the Edson Brothers to trap that stream for trout spawn and establish a small hatchery on their grounds. I was told, however, that but few salmon and trout had made their appearance there during the preceding fall, on account of the dam which had been put in at Klamath City. It had been complained of, and a small fish ladder had been put in, large enough for a small stream, but a wee thing for such a roaring river as the Klamath, with its immense volume of water pouring through the sluiceways with such force that a trout could not stem the current. The fish ladder, with its minute quantity of water, was away at the end of the dam, next the bank, where only a straggling trout or salmon would find its entrance.

I felt discouraged at the prospect of finding a good place for a trout hatchery. The heavy storms drove me home, but as soon as the snow blockade was broken I went up to that region again, and found that the elements, although fierce, had been propitious to trout, which by instinct were compelled to seek the upper Klamath for spawning beds, for the great volume of water, higher than ever known before, had ripped out the dam at Klamath City, and the trout had an unobstructed highway.

I immediately began, early in March, 1890, fitting up a small building, which Mr. Edson loaned me, with hatching troughs flumed in the water, and began building traps for Shovel Creek. The hatching baskets for trout eggs had been built at the Sisson Hatchery during the winter in anticipation of using them there.

Shovel Creek is quite a large stream which empties into Klamath River, within the grounds of the Klamath Hot Springs Hotel. Many of the trout which were spawned would weigh two and one half pounds.

After getting the hatchery in working order and a few thousand trout spawn taken, leaving Mr. Richardson in charge, I went to the Sisson Hatchery and left Mr. Stewart in charge to distribute what salmon were left, to look after the Eastern trout which were being kept until the roads would be open to ship part of them to the McCloud River, and also to receive the trout eggs which were to be sent from the Shovel Creek Hatchery.

TAHOE HATCHERY, 1890.

I now proceeded, accompanied by Mr. Hunt, to Lake Tahoe to open the spring campaign there. The road not being open from Truckee, we had to go up by way of Carson.

On arriving at the hatchery, our house we found buried in snow—it had been twelve feet deep on a level, but in places the wind had drifted it to a great height. After putting new wings to the bag of the old seine, we hired the steamer Tod Goodwin to take our traps, seines, boats, bedding, and provisions up to the mouth of Taylor Creek, twenty miles at the uppermost end of the lake. The steamer also towed up the scow Lillie Van, which was already fitted up with rooms, stove, and cooking outfit. This scow we hauled into the stream: it was to be our home while seining in the lake at the mouth of the creek. The seine was hauled three times a night: once just after dark, again about midnight, and once again before daylight. Some of the nights were so cold that the seine would freeze stiff five minutes after it was hauled out of the water. A bonfire burned while hauling the seine, casting its light over the water; the boatmen could thus see what ground to go over in paying out the seine and rowing in.

They would catch at one haul from five to ten, fifteen, or twenty trout, a few times more and sometimes not any; and many nights the seine could not be hauled on account of the rough sea. A great many Suckers were caught, sometimes as many as three hundred pounds weight at a haul. Some Whitefish were also drawn in. The Suckers were so plump that it was thought they must be full of trout spawn; twelve were opened and not an egg was in their stomachs; but the Whitefish, although small, were full of trout eggs.

The seining continued here some time, till no more trout could be caught. Mr. Burton and I went up the creek to the dam, but we did not see half a dozen trout.

The trout we caught were nearly all ripe; only about seven hundred thousand trout eggs were got at this place. Mr. Burton and Mr. Sam Nichols, who had fished in the lake many years, had prophesied that we would get here all the spawn we wanted.

The seine was drawn through the spring and summer at Meek's Bay, Blackwood Creek, and at the Incline, in Nevada. Traps were put in at Meek's, Phipps', and Blackwood Creeks. The creeks were so high, especially on a hot day when the sun would melt the tremendous snows of the past winter which fell on the headwaters in the Sierra Nevada Mountains. The streams would rise in a tumultuous volume of icy, roily water, which made it very difficult to put in the traps; and after a trap had been put in Blackwood Creek, the water rose two feet over all, tearing the trap out. The trap was put in again, but it was a trying work for the boys: Hunt, Will and Joe Shebley, who, after working in that icy water all day, slept on the banks of the creek in their wet clothes. Fishing was continued up to about the last of July, when the traps were all taken out.

There is usually a large run of trout up Blackwood Creek in March. Some time after we got up there a gill net was set in the current outside the mouth of Blackwood Creek, and nineteen fish were caught, weighing over two hundred pounds—one weighing a little over sixteen pounds. These were towed behind a rowboat, tandem fashion, for about five

miles, by putting a line through the sides of their mouths and fastening it to a toggle of wood; these fish pulled back with the strength of a donkey; they were not ripe, and were put in the settling tank. On the following day, when Will was away on the steamer to Taylor Creek for spawn, six of these large fish were stolen.

The gill net was set every night afterwards for awhile, but the run was over and only a few more were caught. Some of the fish were spawned, and turned out about five thousand of fine looking eggs each.

The past winter was the hardest ever known here, and the snows the deepest. Those who lived at Tahoe said that it snowed almost continuously all the winter. The streams have been booming with icy water all the summer. For some cause but very few fish run up the streams. The fishermen said that the season was a month late, and that the fish would run up by and by; but it was not to be. They all said that the fish must have spawned in the lake. Lake Tahoe was as low as ever was known last fall, and since then it has risen about six feet, being about as high as ever was known; it has also been unusually rough this summer.

A new wharf has been built near the hatchery; a second-hand boat has been bought, and also a scow for seining and for shipping cans of fish. A great many tourists have visited the hatchery, and expressed their admiration of what they see outside of the hatchery as well as inside.

BLACK BASS, 1890.

About August first Will Shebley left the Tahoe Hatchery to go to San Francisco to begin shipping Black bass, leaving Mr. Hunt, who has had charge of the Tahoe Hatchery, with Joe Shebley to distribute the trout now on hand there. After the Tahoe Hatchery is closed for the season, Mr. Hunt will go below and help distribute the Black bass and trout from the Sisson Hatchery. Mr. Richardson will ship trout till the salmon hatching season opens, in the last of September, when he will be stationed at the Sisson Hatchery. The Black bass which we are catching now from San Andres reservoir are from six to nine inches long; these will probably spawn next spring. Seventy-five to one hundred of this size is all one man can conveniently and safely handle on a long journey.

This year, 1890, shipments have been made as follows: One to the Del Monte reservoirs, at Monterey, for the railroad company; one to the Blue Lakes, in Lake County; one to Clear Lake (two shipments were made to this large lake last year); one to the Pajaro River, near Sargent's Station; and one to a lake near San Luis Obispo.

Black bass distribution will continue this fall till as late as possible.

RAINBOW TROUT AT SHOVEL CREEK HATCHERY, 1890.

Trapping in Shovel Creek continued till about the first of July. The water was unusually high, on account of the deep snows on the mountains. About one million six hundred thousand eggs of the Rainbow trout were taken and eyed there; of these, one hundred and thirty thousand were hatched out and distributed in Shovel Creek—this was to give back the seed for the future from the harvest of eggs which we had gathered there.

One hundred thousand eggs were shipped to the North Pacific Game

and Fish Club, and were hatched out by Mr. A. V. La Motte, at his hatchery in Glen Ellen; and which, he writes me, were distributed in Sonoma and Robinson Creeks, in Sonoma County and Mendocino County, respectively. This club, by permission of your honorable Board, trapped Sonoma Creek last winter for spawning trout, and Mr. La Motte reports that fifteen thousand native trout were restored to that stream.

One hundred and fifty thousand eggs were shipped to Mr. Alex. Badlam and hatched out in his trout hatchery at Arcadia, near Mount St. Helena. These were—part of them—for his ponds, and the rest, Mr. Badlam writes me, were distributed in streams, as follows: In Sulphur Creek, near the Geysers, in Sonoma County; in Lokonoma Creek, Anderson's Creek, Grizzly Creek, and Bradford's Creek, in Lake County; in Bear Creek, near Arcadia, and Troutdale Creek, Napa County. Mr. Badlam trapped Bear Creek last winter for spawning trout (with permission of your honorable Board), and reports that he restored to that stream fifteen thousand native trout as the result.

Fifty thousand eggs were shipped to Mr. Knowles, who has a hatchery near Alma; these were hatched out all right, but by some mishap they did not do well. I shipped a second fifty thousand to him, with which he had good success. These were distributed: about twenty thousand in Bear Creek and Deer Creek, branches of the San Lorenzo Creek, in Santa Cruz County; the balance was divided between his own ponds and a branch of the Los Gatos Creek.

Fifty thousand eggs were shipped to the hatchery at the Hotel Del Monte; this lot did not do well through want of experience and the high temperature of the water, owing to its being so low in the reservoir from the main pipe having washed out last winter. I shipped a second fifty thousand eggs there; they hatched out, and, with more experience on the part of the attendants, did well. These have been distributed in their reservoir and in the Carmelo River.

The hatching out of these eggs sent to private hatcheries, their expressage from Shovel Creek, and the distribution of the young trout, has been done free of expense to the Commission. This saved to the Commission the cost of distribution of the young fish from the Sisson Hatchery, which would have been a large item, and was also the means of stocking many streams which would otherwise have been impossible this year.

I visited the Del Monte Hatchery several times, Mr. Knowles' hatchery twice, and Mr. Alex. Badlam's hatchery once, to give instructions.

Hon. A. R. Williams, Ramen Wilson, and a number of other gentlemen have made arrangements to build a trout hatchery at Webber Lake for the purpose of maintaining the supply of trout in that and Independence Lakes and in the streams in their vicinity.

The thanks of the Commission and of the people of the State are due these gentlemen for their unselfish interest and laudable efforts in behalf of the fishery interests of the State.

I am satisfied that the efforts of these gentlemen will meet with every success, and that they will at all times receive the encouragement and support of the Commission.

Fifty thousand of these Rainbow trout eggs were shipped to the State Hatchery, at Tahoe, on application of Commodore Todman; these were

hatched out and planted in the Truckee River below the dam at the outlet of Lake Tahoe.

The balance of the eggs, about one million, was shipped to the Sisson Hatchery; these eggs and the young fish did finely in the cold water at Sisson. They have been fed in the troughs for several months awaiting shipment.

After the eggs were all taken at Shovel Creek, Mr. Richardson began shipping these fish from Sisson for distribution, taking ten cans at a trip, and about three thousand fish in a can, or thirty thousand to each trip, which are as many as it is safe to handle on a trip in hot midsummer, the round journey averaging about eight hundred miles, and taking about three days' time.

A trip with this number has been made to Lagunitas Lake, Marin County, and to about five miles down the Lagunitas Creek, below the dam; also, to the following places: to Crystal Springs Reservoir, San Mateo County; to Alminitos Creek, near the New Almaden Mines; the Guadaloupe Creek, Saratoga Creek, and to Smith Creek, near Mount Hamilton, a branch of the Calaveras Creek; to the Arroyo Mocho, twelve miles south of Livermore, and the Calaveras and the Alameda Creeks, near Sunol; to Monterey County, for branches of the Salinas River, near Salinas and Soledad; to Bowlder Creek and other branches of the San Lorenzo Creek, in Santa Cruz County; to Almao for the Los Gatos Creek, in Santa Clara County; to the San Gregorio Creek, over the mountains from Redwood City; to Gilroy, for the Uvas Creek; to the Lagunitas or Paper Mill Creek; to Napa City, for branches of the Napa Creek; and to a small creek, near Santa Rosa, a branch of the Russian River.

Arrangements have been made to ship these trout to Dr. Smith, of Placerville, for the American River; also, to Judge McD. R. Venable, in San Luis Obispo County, for streams there; to the Sonoma Creek, Cache Creek, in Yolo County, and other places. We shall continue to ship these trout until their trough room will be needed for the salmon at Sisson, or until we are admonished to quit shipping to save funds for our winter and spring work. Those which are not shipped to the central and southern parts of the State, will be planted in the Sacramento River. There have been already planted during August, 1890, in branches of the Sacramento, one hundred and fifteen thousand, distributed thus: West Fork, Sulloway's Creek, Cold Creek, School House Spring Creek, and near Peter Klink's place. The balance for the Sacramento will be distributed below the eighteenth crossing.

During both seasons of our work at Lake Tahoe, in 1889 and 1890, Commodore Todman has been exceedingly generous in his aid to advance the work of the Fish Commission by giving at all times free transportation on the steamer Tod Goodwin to all parts of the lake, shipping our racks for traps, fish cars, seines, towing the boats to the different streams, shipping our supplies, and also giving almost daily passage for the men in their traveling to the creeks where the traps were, for eggs, and in shipping the trout for distribution.

Captain Wherman and his men on the Tod Goodwin have also been very kind and willing in helping us, by doing many errands at distant points of the lake. Mr. Lawrence, of the Tallac House, and Captain Holt, also generously gave us free passage on the steamer Tallac. The citizens around the lake gave us many accommodations.

It would have been impossible for the Department of Hatcheries and the Restoration of Fishes to have done with its small funds the amount of work it has accomplished without the generous help which the Southern Pacific Railroad Company has extended in giving an annual free pass to the Superintendent to all parts of our State in his frequent trips to the hatcheries from San Francisco; also, in giving free passage in the baggage car for the salmon and trout eggs and all the cans of trout in the many shipments for distribution from the Sisson Hatchery, in the shipments of Black bass, and free passage for the attendants with the fish. The railroad people were very kind also in giving us the use of a handcar and right of way on their road in shipping the young salmon down the Sacramento for distribution. I would like to give an instance in which the railroad people have shown their kindness to the Fish Commission, and at the same time show why but few salmon have been up the Sacramento to spawn during the fall run for a long while past.

I was told by different parties that at a point on the Sacramento River, near the railroad tunnel No. 3, there was a horseshoe bend in the river; through the neck of this bend a mining company, years ago, had made a tunnel to drain the river in the dry season, so that they could mine the bed of the river around that bend. In August and September, when the salmon make their great migrations to their spawning beds, it was noticed that for years past but very few salmon made their appearance in the Sacramento River above the bend, while in early times the salmon went up in thousands.

In August and September the river is very low, and most of the water went through this tunnel, leaving so little water in Horseshoe Bend that it was almost impossible for the salmon to make their way up, while they congregated in thousands at the lower end of this tunnel, where the volume of water came through with such force, and made such a jump off into the river below, that the fish could not get up. Here the Indians, and also white men, would assemble, and while the salmon were using up their strength in continually making ineffectual efforts to leap up into the tunnel, they would destroy them with grab hooks and nets. This point is but a little way above where the Pitt River joins the Little Sacramento.

I determined to stop, if I could, this destruction of salmon and give them a chance to get up on their spawning grounds and deposit their eggs. I went down to this tunnel and made an examination, and saw at a glance that the railroad people—with their ties and old bridge timbers, with their handcars to carry them to the tunnel, and the crews of road repairers to do the work of putting in the timbers to face the tunnel, and blasting down the overhanging bank to fill up the open cut—could do the work much cheaper than I could. So I called at Fourth and Townsend Streets and told my story to the railroad people, showing the importance of this tunnel being closed up, that the salmon now being stopped there might not be hindered in making their way up the river to their spawning grounds; and asked them if they would not, as a great favor, have this job done by their men and send in their bill of expenses to the Fish Commission. They readily assented to have the work done, and, at the same time, said that if it did not cost too much, no charges would be made. In a short time they had the tunnel closed (1889), but, owing to the great pressure of the waters in the floods of the present year, 1890, the dam at the tunnel was torn out.

During the past summer it has been closed again, and the salmon will now have an unobstructed highway up the river.

The Fish Commission is also under obligations to the San Francisco and North Pacific Railway for free transportation, and also to the North Pacific Coast Railroad, both giving the use of their baggage cars and free passes for the attendants over their lines in shipping trout and Black bass for distribution.

I wish here also to acknowledge the many courtesies and aid extended to the Fish Commission by the many applicants for trout and Black bass, who have furnished teams to transport the fish and attendants from the railway station to the streams for planting; also, to Mr. J. H. Sisson for the use of the ground and the water for the Sisson Hatchery, and to the Edson Brothers for the use of the ground for the Shovel Creek Hatchery on their hotel grounds, and the privilege of trapping Shovel Creek for trout.

HAT CREEK.

I visited Hat Creek to see what advantages the State Hatchery there offered for hatching salmon. The hatchery at Hat Creek is a large building one hundred feet by forty-six feet, with sixty-four troughs sixteen feet long and twelve inches wide. The building has settled at its upper end owing to poor underpinning; the troughs have the grade the wrong way. The dependence for water is from a ditch owned by private parties, who use it for running machinery. The water comes through the ditch from up Hat Creek, and the ditch is dug through a formation of infusorial earth which is disintegrated by frost, making it very loose and friable; it crumbled into the water in the ditch, and was held in suspension in such quantities that it covered up the eggs in the hatching troughs.

The proper way is for the Commission to have entire control of the water for the hatchery. Copartnership in a ditch causes trouble, and the water is liable to be turned off entirely from the hatchery, which would cause, if it lasted for a few hours, the entire loss of all the fish and eggs. The water could be brought into the hatchery by an undercurrent wheel built in Hat Creek, near the upper end of the hatchery, which would give a large quantity of clear, cold water, and would, if built strongly, give a certainty to the continuousness of the supply; for Hat Creek never rises, as I have been informed, over eight inches above low-water mark. Hat Creek has a large volume of water at all seasons.

I think the more suitable place for the hatchery would be at the confluence of Hat Creek with Pitt River, on a point of land about two miles below the present site of the hatchery, where a large spring flows of clear, cold water; and as it is at the lower end of a fall or riffle in Hat Creek, a ditch of short length could be cheaply made to bring water for ponds. Opposite, and close at hand, is a seining place in Pitt River, and at this point, also, in Hat Creek, a trap could be built, as well as in Pitt River, to trap salmon and trout for spawners. The hatchery and spawning traps would be close together, which is of great importance for accommodation and security. (Fourteen years ago, when the old Board of Fish Commissioners gave me instructions to survey the Pitt River Falls, I selected this place as the most suitable for a salmon hatchery, if one ever should be built on Pitt River.)

There are not many salmon running up Pitt River, it is said, but if these

were caught and spawned, and the numbers supplemented by eyed eggs sent from the United States Hatchery on the McCloud River, a plant of two millions could thus easily be deposited in Pitt River and Hat Creek, which would be good nursery grounds for these fine fish to increase their numbers on the fishing grounds of the lower Sacramento River.

THE CLOSE SEASON FOR SALMON.

To prevent any depletion of our rivers, while the present great draft upon their fish supply is going on, to meet the demands of the canneries and the local markets, it is necessary that a sufficiently large number of young salmon should be hatched out naturally as well as artificially. It will be impossible to keep up the supply of salmon from artificial hatching alone for this reason, that the nursery grounds, which are accessible to distribution of the young salmon that are hatched artificially, are not extensive enough to meet and fully supply this great demand. We must have the aid of the salmon of the spring run to supplement our efforts, by stocking the highest mountain streams. The young salmon should be placed upon a great extent of nursery grounds for food and protection, to keep up the supply of mature salmon to return from their stall feeding in the ocean.

In order that this may be successfully accomplished, it is essential that the close season for salmon should be sufficiently long to give a free highway to enough breeders to ascend to the extreme headwaters of the salmon-breeding rivers to deposit their spawn over a large extent of nursery grounds beyond where teams can go to distribute cheaply the young fish from artificial hatching.

There are two great runs of salmon up the Sacramento River: one in March, April, and May, and another in August and September; but salmon are caught in considerable numbers during every month in the year.

RUN OF MARCH, APRIL, AND MAY.

It is very essential that a close season of two or three weeks in the month of April be enforced, in order to give a clear road for the passage of a part of the cream of the great run of the salmon in March, April, and May. It is the salmon from this run which reach the upper waters of our rivers, where they are almost inaccessible to man. Especially is this the case on the McCloud River. Above the United States Salmon Hatchery, which is about two miles from the confluence of the McCloud with the Pitt River, there are only four white men and but few Indians; and above the last white man on the river, eight miles beyond the United States Hatchery, for some sixty miles, till you reach "Horseshoe Bend," there is scarcely a soul to be found, when the spring run of salmon go up, to "molest or make them afraid" when passing through this long reach of the best salmon-breeding river in the world.

It is a fact well known to fish culturists that the winter and spring run of salmon, during the high, cold waters, go to the extreme headwaters of the rivers if no obstructions prevent, into the highest mountains.

They are in the very best condition when they start on their long journeys. Nature has implanted in them the instinct to begin their journey while the spawn is yet small, that it may not become full grown

and ripe for depositing until they reach their far-distant spawning grounds.

As they eat nothing while on their journey up the rivers, and with their fighting and exertions to overcome this distance, a great deal of the way being through a swift, racing current, and also with a constant draft upon their own vitality to mature their spawn, they become much exhausted and emaciated.

These fish cannot be used for spawning artificially, for at this season the waters are too high to catch them, and they are too unripe when they pass the United States Hatchery on the McCloud River to catch and impound them; in the attempt to keep them till they become ripe they would all die before they were ready to spawn. They will kill themselves if kept long in confinement, in their frantic efforts to get free to ascend to their spawning grounds.

THE CLOSE SEASON FOR THE AUGUST AND SEPTEMBER RUN.

The spawning time at the Government Hatchery on the McCloud River for the great run of salmon in the late summer and fall is principally during the month of September; it usually opens about the twenty-eighth of August and continues until the latter part of September.

The vital points of the question in considering the time for the close season are: At what time should the close season begin at the fishing grounds on the lower Sacramento River, and how long should it last in order that enough breeding salmon from the great run during the months of August and September may reach the United States Hatchery on the McCloud River, during the month of September, to furnish sufficient eggs for the artificial hatching of young fish for distribution on the nursery grounds to maintain the supply of mature salmon for food, which the rivers for nursery grounds and the ocean for feed till the salmon are matured, are capable of producing?

Ten years ago, during the administration of B. B. Redding, S. R. Throckmorton, and J. D. Farwell as Fish Commissioners, as many as fourteen millions of salmon eggs were taken during the month of September from the fall run of salmon.

The close season at that time was during the month of August.

The close season is now, and has been for some years since, during the month of September.

The Government Hatchery, on the McCloud River, renewed its operations in 1888. The number of eggs taken in September, 1888, was only about one million five hundred thousand; and in 1889, only about one million one hundred thousand eggs: or, averaging for the two years, less than one tenth as many eggs as were taken ten years ago, when the close season was during the month of August. This is a loss of 90 per cent.

For what cause, or by whose agency the close season was changed from the month of August to the month of September, I do not know. It was certainly a very disastrous change, if the interests of the salmon were considered.

During the last Legislature, in 1888, a bill was introduced by some one—from Solano County, I believe—to change the present close season for salmon from the month of September to the month of October.

If this bill had become a law, the close season would have been

pushed entirely beyond the season of the great run of salmon. "Give them an inch and they will take an ell," if they can get it.

It is of the utmost importance that the close season should be placed back again to the month of August. If more salmon do not reach the McCloud River during the month of September than have arrived there during the past two years, serious consequences will happen to the salmon industry of California.

By changing the close season for salmon back again to the month of August, it can easily be determined if the run of salmon has lessened during the past ten years.

If as many salmon do not arrive there during August and September as did ten years ago, or if an insufficient number got up during that period from which to secure the number of eggs necessary for artificial reproduction, then it will be imperative to include part or the whole month of September in the close season, in addition to the month of August.

I see no reason why this change should have been made in the close season, unless it may have been to accommodate the canneries and fishermen on the lower Sacramento in securing greater catches of salmon.

If there is any accommodation to be done in the matter, it should be towards the salmon which are trying their best to reproduce themselves in the effort that their kind may not be diminished, and not to those who are doing their best to destroy the salmon for the future that they may fill their pockets to-day, and "kill the goose that lays the golden egg."

Can it be possible that the people of this State will allow a great resource of food supply, which Nature has planted in our rivers, to be endangered by the remorseless destruction going on in the effort to catch every salmon that attempts to go up to the spawning grounds?

The following valuable communication has been received from Mr. Geo. B. Williams, Jr., and I take great pleasure in submitting it to the consideration of your honorable Board, as it so strongly represents the facts of the case:

BAIRD, CAL., July 8, 1890.

Mr. J. G. WOODBURY, *San Francisco:*

DEAR MR. WOODBURY: Yours of the fifth at hand. Two years of experience in charge of this station on the McCloud has convinced me that unless some action is taken by the Legislature and those interested in the propagation of salmon as a food fish, to include the month of August as well as that of September in the close season, not many years will elapse when this valuable food fish will become almost extinct.

On account of the high water we are liable to have at this point during the spring and late fall runs, it is impracticable to secure and spawn by artificial methods the parent fish; but the August run comes at a time when it can be handled successfully. In order to allow this run to reach the headwaters of the Sacramento River and its tributaries, the months of August and September should be reserved to allow a free passage of salmon.

I draw my conclusions from the fact that in previous years, when there was no fishing with seines in the Sacramento to speak of, thousands of salmon collected here during the latter part of August and during the month of September, and we found no difficulty in securing all the eggs we could handle, fourteen million ova having been taken in one season. From the August run in 1888 but one million five hundred and sixty-eight thousand six hundred eggs were secured, and in 1889 one million one hundred and five thousand were taken. In 1888 the season's take was increased to five million five hundred and four thousand six hundred, by securing ova from the late run in October and November. But this was something unusual, and could not have been accomplished had it not been that the rains did not set in until December of that year. An attempt was made in 1889 to take the late run, but rains in October caused the McCloud to become very high, and racks and dams were washed out, allowing the parent fish to ascend the river and small creeks above the station.

It is very hard to decide how long it takes the salmon to reach their spawning grounds after they leave the seining grounds of the lower Sacramento, but as near as we can tell, from two to three weeks.

As you know, the work done at this station is almost entirely for the State. It seems as if it should be the aim of the people to do all in their power to aid the United States Fish Commission to accomplish its object by making laws that will protect this valuable food fish.

Much more could be said regarding the tremendous decrease in late years of the salmon, but I think I have advanced sufficient reasons to show that a longer close season is necessary to make a success of our work. It is a question that should be seriously considered and acted upon at once.

Yours truly,

(Signed:) GEO. B. WILLIAMS, Jr.,
Superintendent of Station.

STRIPED BASS.

There were brought to this coast in 1874 some one hundred and fifty Striped bass, about one and one half inches in length. From these quite a number of mature fish were caught in years afterwards, but it was not certain that they had reproduced themselves, and it was thought best to have another shipment of these fish brought out to this coast, to make it as sure as possible that these excellent fish should become familiar in our waters.

By instructions of the Board of Fish Commissioners, B. B. Redding, S. R. Throckmorton, and J. D. Farwell, in 1882 I brought out from the Shrewsbury River at Red Bank, New Jersey, just above Monmouth Park, a shipment of Striped bass, running from five to nine inches in length, and planted them in Suisun Bay, at Army Point. Quite a number of these have been caught from year to year, increasing in weight every year. Last year several were caught weighing over twenty pounds, and during the past winter one was caught weighing thirty-five pounds.

I have been watching for the young fish, the progeny of those brought out in 1882, and during the past spring, on my return from a trip to Tahoe Hatchery, I heard that they were being caught by the thousands and offered for sale in the market. I hurriedly went up to the market to see if it were true. I found there a lot still unsold, averaging from one half to three quarters of a pound in weight. I was delighted to see them, knowing that those brought out from New Jersey must have kept together in the muddy waters of our bay till they matured and spawned, and their young had been successfully reared.

But knowing that the young Striped bass run in schools, I became alarmed lest the many Chinese nets in our bay and the lower Sacramento and San Joaquin Rivers would soon destroy the greater part of them, which would be a great pity, as they had cost so much money, trouble, and time in waiting for them to reproduce themselves. And if these young fishes could remain unmolested for a few years longer, till they themselves had spawned, our bays would be full of these splendid fishes. Certainly this would be a great acquisition to the whole Pacific Coast.

I immediately visited the newspapers, and they kindly published a notice of the arrival of the numerous strangers, of their great importance, and the danger of their destruction if they were not protected.

Your honorable Board petitioned the Board of Supervisors to pass an ordinance to prohibit catching them under eight pounds in weight. This they quickly did. A similar petition it would be advisable to present to the Boards of Supervisors of Marin, Sonoma, Solano, Contra Costa, Alameda, San Joaquin, and Sacramento Counties. The young bass will most certainly visit the waters of all these counties, and their protection for a few years is of vital importance.

I have since learned from the market men that from three to four thousand of these fish were sold in the market before the ordinance was passed, and that it has since been in the newspapers that these fish have been caught and sold in other counties around our bay.

The arrival of so many young of this fish at one time in our markets, shows conclusively that the Striped bass have successfully reproduced themselves in our waters. Our anglers may anticipate some grand sport in a few years.

I am happy to give the people of California some desirable information about this useful fish, and take the opportunity of appending to my report a valuable paper taken from "The Fisheries and Fishing Industries of the United States," by George Brown Goode.

NECESSITY FOR A TROUT HATCHERY NEAR SAN FRANCISCO AS A DISTRIBUTING POINT.

California is a large State in territorial area, approximating to three times the size of the State of New York.

The headwaters (the breeding places for trout and salmon) of most of the large streams in our State are far away from the railroads, and are also in high altitudes. To reach these is, in most instances, a weary road to travel by stage coach and teams, and in some cases by horseback only, following Indian trails through almost impassable cañons and mountain gorges

The Sisson Hatchery, which is at present the distributing point for the Rainbow trout, is about seven hundred miles from the southern border of the State, and applications for trout come in from Siskiyou to San Diego Counties.

To distribute fish into these streams over such a vast territory is very expensive, and the cost is much increased by the many difficulties in getting to their headwaters with teams heavily loaded with ice and cans of water, over the long, hot valleys, and up steep mountain roads.

It is also unsafe to transport young fish in large numbers over such long distances.

To ship half a million of eyed eggs is comparatively inexpensive to what it is to ship the same number of young fish. Thirty thousand young trout in eight to ten cans of water is as much as it is safe for one man to carry on a long journey. This means half a ton of water and hundreds of pounds of ice.

Express charges for this great weight are heavy; the cost of the ice, railroad fares to and fro, teams to transport the fish from the railroad to the streams (sometimes for sixty miles to their headwaters), hotel expenses, and telegraphic charges rapidly eat up our funds.

Two men are compelled to go on long journeys to care for the fish, as the water in the cans has to be almost continuously aerated night and day to give the fish fresh air to breathe, and the water in the cans requires occasional changing.

A trip with trout from Sisson to the southern part of the State consumes nearly one week's time, which is very dangerous to the safety of the young trout, and limits the number of trout which can be distributed. To make these journeys shorter and less expensive, with saving of time, and with more certainty that less fish will be lost in their transporta-

tion, it is essential that a string of hatcheries should be established as is done in other States.

We have already built and equipped two extensive hatcheries: one at Lake Tahoe as a point for distribution for the mountain region and the eastern slope of the Sierras; and a large hatchery at Sisson, which was built for the purpose of stocking the Sacramento River with salmon. This can be used as a distributing point for the northern part of the State for trout also; and a small hatchery on Shovel Creek, which is for eyeing the eggs of trout to be shipped to other hatcheries as distributing points.

Now, it is very essential that a hatchery with nursery troughs (space sufficient to accommodate one million of young trout till they begin to feed, or till they are old enough to be distributed in the streams) should be built during the coming winter in or near San Francisco, as a distributing point for the waters in Central California, to which the eyed eggs can be sent from Shovel Creek or some other hatchery.

A plain hatchery for this purpose, well equipped, with quarters for the men, would probably cost from $1,000 to $1,200.

The demand for trout will be the greatest from a hatchery here to keep up the supply in the many streams in this part of the State, to meet the growing wants of the many anglers in the counties surrounding the bay of San Francisco.

This place is also the center from which radiates all the many routes of travel by which the trout can be conveniently shipped to all parts of the State without delay.

After full consideration of these matters by your honorable Board, if I have presented the subject in a proper light to convince you of its importance, I would suggest that a petition be presented to the incoming Legislature in the first days of its session to make an appropriation of $1,000 to $1,200 for a new hatchery and its equipment and quarters for the attendants, the money to be immediately available, so that work can begin in time to have it finished to receive the first trout eggs in the early spring of 1891.

APPROPRIATIONS FOR THE SUPPORT OF HATCHERIES AND RESTORATION OF FISHES.

As the field of fish culture and propagation is continually increasing, the appropriation for this department must also increase with its development. The appropriations, owing to the immense area of California, should at least approximate those of Eastern States (which are devoted almost entirely to hatcheries and the restoration of fishes). The State of New York, which is of one third less area, makes an annual appropriation of from $30,000 to $35,000 to enable its Fish Commission to carry out its work. This department is being continually hampered by want of funds, and is compelled to forego the necessity of making constant improvements. Efficiency, thorough and satisfactory, cannot be had without incurring expenses far above the present limited appropriation in the department embracing Hatcheries and Restoration of Fishes.

It is doubtful economy that hinders the cheapening of food for the people.

It seems absurd to appropriate so small a fund as $5,000 to foster and maintain the fish industries of this State. A resource furnishing a staple

article of food for the people—a cheap and plentiful supply of wholesome food—is of immense importance. The waters of California are almost unlimited in their capacity to produce fish food, but wanton destruction of fishes when they congregate at certain seasons of the year for breeding purposes, and the increasing demand on them to supply an increasing population with food, will soon largely diminish their numbers unless assistance is rendered by artificial reproduction on a greater scale than is being done at present.

When live stock is owned by private parties it is to their individual interest that the best care be taken of it to the end that it may make the most remunerative returns. But the fish which the waters of our State produce are the common property of the whole people, and it is not the duty of any one individual to see that the fish interests are cherished.

AN ANNUAL APPROPRIATION OF TWELVE THOUSAND DOLLARS NECESSARY.

It follows that it is the duty of the Legislature to appropriate adequate funds to meet the expenses incurred in carrying out the work necessary to such an important trust.

This work embraces the artificial reproduction and distribution of young salmon upon their nursery grounds to keep up the supply to meet the immense draft upon their numbers as they annually migrate as mature salmon from the ocean to their spawning grounds, by the fishermen's many miles of network and seines, catching them to supply canners and the local markets.

If this work is not kept up from year to year, it is certain that their number will be diminished, and in time salmon will become as great a rarity in California as they are to-day in New England.

The artificial reproduction and distribution of trout over this State to satisfy the increasing number of applications for these fishes to supply the depleted streams which our growing population in their search for health and recreation exhaust, it is far beyond the unaided powers of trout to keep the streams well stocked; and as far as the present appropriation for this costly work goes, it is only a make-believe towards accomplishing what the real work should.

It would be most desirable to continue the purchase of the eggs of the Eastern Brook trout—that pride of the trans-mountain angler—for their introduction into the headwaters of all our high mountain streams, where it has been demonstrated they have done well in the past, and it is but reasonable to suppose that as they become acclimated they will gradually descend the rivers and spread themselves over the whole State.

The Black bass is such a desirable fish that, as we already have them, it would be a public benefit to systematically distribute them into all the suitable waters of the State. When once planted they become permanent "settlers," no restocking is necessary, and it would be well to do this work quickly.

I would recommend the introduction of the eel, which is highly esteemed in the East and in Europe; in fact, it is considered a luxury, and is preferred by many to the trout. The flesh of the eel salted, smoked, and pickled, forms quite an article of trade, and will in time afford a large addition to the food for the people.

Many have asked for the introduction of the Big-mouthed Black bass from the Southern States for planting in our warmer waters; also, the big catfish of Texas, which occasionally weighs three hundred pounds. It is said that it would be very desirable for the Sacramento and San Joaquin Rivers.

A part of the fund should be expended for the scientific investigation of the economic fishes of our State, and experimenting in artificial reproduction of others fishes, among them the sturgeon, which valuable food fish is becoming notably scarce.

For all of the foregoing, which is expensive field work, the present appropriation of $5,000 is ridiculously insufficient, and it is needful that $12,000 should be annually appropriated for the sole and exclusive use of this department.

Therefore, I would suggest to your honorable Board that you would petition the Legislature for an annual appropriation of $12,000 for the Hatcheries and Restoration of Fishes.

SCREENS FOR DITCHES.

Most ditches take their supply of water from the streams above the valleys, from the lower foothills to far into the high mountains.

Our mountain streams are good spawning grounds for trout and salmon.

The young trout, as soon as able to swim, leave their hidden recesses in the gravel and seek the shallow water near the bank or shore of the streams where the water is less swift. Here they are better able to stem the current, and are also comparatively safe from the raids of larger fish which live in the deeper water, and are cautious about venturing into the shallow water.

Ditches, of course, take their supply from the shores of these streams. The current at the inlet of these ditches is strong, and draws the little fellows down with the water farther and farther. The current within the ditch is so strong that they cannot get back, hardly, even if the instinct of fear impelled them to do so.

But they go with the current willingly. Mother Nature has not taught them that these side issues from their native brooks lead to their destruction, by distributing them with the water to nourish the roots of alfalfa and timothy grasses, or through the great fields of the raisin grape or wine vineyards and orange orchards; nor by being dashed over the rocks through nozzles of miners' pipes, nor by being ground up into mince meat by the turbine wheels of sawmills and papermills.

These thousands of ditches tapping the mountain streams the whole length of our State, from Oregon to Arizona, destroy ten times more fishes, especially the trout and salmon, than is done by all other means of illegal destruction of fishes. The numbers of trout destroyed through the agency of ditches will run up into millions every year.

This great destruction of fishes is self-evident to every man who taps a trout stream for irrigating purposes, unless the process has been going on so long that the stream has already become barren of fishes.

I have already cited an instance in this report of the great destruction of trout in Siskiyou County by a ditch from Shasta River, which was told to me by the owner of the ditch.* I have known of what I write by observation in traveling over this State during the past twenty years.

*Refer to trip to look up a trout hatchery in 1889.

Hundreds of men have told me the same story, and angrily denounced such wanton destruction of trout, saying that in a few years, unless there was a stop put to it, there would be but few to destroy. Those who use the waters from these ditches admit the facts. I do not believe there is a man in the State who knows anything practically about the use of ditch water but who will admit what I have stated about the great destruction of trout is substantially true. I will instance a case which happened last year not far from the hatchery at Sisson.

A lot of young salmon had been distributed in Big Spring Creek. At that time we were not aware that there was a ditch taking water from this creek, but it happened there was one whose inlet was from the opposite bank from the road, hidden from view by a thick growth of alders.

Some time after the salmon had been planted, at a considerable distance above this ditch, its owners had occasion to shut the water off. After the water had drained away they saw so many dead salmon, that word was sent to the men at the hatchery who went up to investigate, and they estimated that about seven thousand young salmon had perished. What is the use of stocking our streams with fish to have them killed off by wholesale in this manner?

It is well known that in early times all the mountain streams through the mining counties were bountifully stocked with trout, and where there are at the present time hundreds of ditches taking water from these streams for irrigating and mining purposes. All these streams have fine spawning grounds for trout for miles far above where the mining debris has been deposited, and even where it is almost impossible for an angler to go. And besides these counties are not thickly populated, and the streams cannot have been fished to excess. Yet the people in these mountain counties are asking for trout to restock their streams.

All these streams would be full of trout if it were not that they have been destroyed by the open ditches.

To stock these streams with trout, whose waters are taken out through ditches without screens at their inlets to protect the young fish from being drawn into them and destroyed, is a waste of time and money. It is as ineffectual as it would be to try to dip up water in a sieve.

If it is of material consequence to keep our mountain streams stocked with trout and salmon, then it is imperative that a law should be passed compelling the owners of all ditches, flumes, and pipes which take their supply of water from public streams, to maintain screens across their inlets of sufficient fineness to prevent young trout from finding their way through.

In regard to the size of the mesh, it is of the utmost importance that it should keep out the young trout, and yet let through enough water for the requirements of the ditch.

The mesh of the screen should not be larger than one fourth of an inch square.

To let in sufficient water with this size of mesh, and not require but little attention to keep off rubbish, the surface of the screen should be two or three times larger than the cross-section of the ditch.

The ditch or flume should be enlarged at its inlet or mouth by flaring its sides to accommodate this size of screen.

A good way to put in a screen which will prevent the young fish from being drawn against the wire, as well as the floating stuff in the stream,

which would have a tendency to choke the screen, and, of course, let in less water, is to have the flaring end of the flume flush with the bank of the stream, and fitted with cleats to receive a light wooden frame.

To this frame should be fastened an oblong square basket made of the screen wire cloth. The depth of the basket should be a foot or so, according to the size of the ditch. The screen being in place, the depth of the basket would thus project into the stream, and have the two ends, one side, and the bottom of the basket as a screen surface.

The upper end of the basket would, of course, be more or less clogged up with floating stuff, but the under side and the lower end would be almost entirely free, while the bottom of the basket, or outer surface, which should be nearly parallel with the current of the stream, would be kept comparatively free from floating stuff by the current itself.

This basket screen, being loosely fitted between the cleats, could be easily taken out, and with a few splashes in the stream cleared of all rubbish.

A coarse rack of slats outside of the screen would keep off any large floating substance, which might otherwise injure the basket, and with a boom fastened at the bank above the ditch, and swung diagonally part way across the stream and fastened in position, would ward off most of the floating debris.

Of course, if the main ditch at the stream has a screen, the smaller ditches taking water from the main ditch will require none.

Galvanized wire cloth of one quarter-inch mesh, strongly made, and soldered at each intersection of the wires, can be bought in San Francisco for 6 cents per square foot.

The cheapness of the wire will make the cost of a good sized screen but a small item. And with a little of our American ingenuity in constructing it, and an ardent desire for the safety of our trout, screens can be speedily placed at the inlet of all ditches.

Accompanying this report will be found a copy of the Screen Law of Wyoming, which Fish Commissioner Louis Miller kindly sent me.

The Striped Bass. Roccus Lineatus.

Geographical Distribution.—The Striped bass, as has already been stated, occurs in all the waters of our coast from latitude 50 degrees to latitude 30 degrees. In the North it is called the "Striped bass," in the South the "Rock-fish," or the "Rock." The neutral territory, where both these names are in use, appears to be New Jersey. The fishermen of the Delaware use the latter name; those of the seacoast the former. Large, sea-going individuals are sometimes known in New England by the names, "Green-head" and "Squid-hound." There is still some uncertainty regarding the southern limits of the distribution of this species. In the Saint John's River, Florida, they are very unusual. Though familiar in the fisheries of that region since 1873, I have only known of the capture of two individuals. Mr. Stearns has obtained one or two specimens in the Gulf of Mexico, and gives an account of the degree of their abundance in those waters. He writes: "They are occasionally caught on the northern shores of the Gulf, and are, evidently, more common about the mouths of the Mississippi River than elsewhere. Since they are taken in this region only in seines, and in shallow water, their abundance cannot be correctly determined. The earliest I have been able to obtain of the capture of Striped bass in Pensacola Bay, is

that of Captain John Washington, of Mystic, Connecticut, who states that in 1850, while seine fishing from the smack "Francis Parkes," he surrounded with his seine a large school of fish which were quite unmanageable. A few of them were saved, and proved to be large Striped bass, weighing from fifteen to forty pounds. At long intervals since, solitary individuals have been taken at various points on the coast. At New Orleans it is found in the market quite often. An eighteen-pound specimen was sold there in March, 1880."

In Hallock's "Sportsmen's Gazetteer" the following statement occurs: "It is constantly seen in rivers of fresh water at great distances from the ocean, even as far up the Mississippi as St. Louis, and it is common in White River, Arkansas, and in all the rivers of the Southern States."

While there can be no question that straggling individuals of this species have been taken in the Gulf of Mexico, it seems probable that both Mr. Stearns and Mr. Hallock have been mistaken by the resemblance of this species to the Brassy bass (*Roccus interruptus*), which abounds throughout the lower Mississippi Valley.

Canadian authorities inform us that, though the bass still occur along the New Brunswick and Nova Scotia shores of the gulf, they are much less abundant and of smaller size than formerly. They have been known to ascend the St. Lawrence as far as Quebec, and Mr. Roosevelt has seen a specimen, a female fish, which was taken in the Niagara River near Lewiston. The bass is most abundant in the bays and inlets of Cape Hatteras, in the Chesapeake and Delaware Bay region; and in the protected waters of Long Island and southern New England. In winter they occur in considerable numbers in the Altamaha River, and are unusual in the markets of Charleston, South Carolina.

Habits.—The Striped bass is not migratory, being found along our coasts in winter as well as in summer, and in our markets in every month in the year. Great quantities are taken in winter in the rivers tributary to the Chesapeake, and in the rivers of New Brunswick quantities of them are speared through holes in the ice. During the past four years I have known of their capture in Long Island and Block Island Sounds, and in the Merrimac River in December, and in Martha's Vineyard Sound and in the lower part of the Hudson River in January. Though they appear to avoid a temperature higher than 65 or 70 degrees, they are not sensitive to cold, and there is good evidence that they frequently, when detained throughout the winter in shallow places, enter upon a state of torpidity.

Food.—They are very voracious feeders. Entering the rivers, they prey upon small fishes. They are particularly abundant at the time of the spring runs of the shad and herring, and at this season are particularly plump and well fed, doubtless owing to the ease with which they can obtain food. They also frequent the rocky shores of the bays and sounds at high tides, in search of crabs, shrimps, and squids; and they are said to feed upon clams and mussels, which they obtain by delving with their snouts.

Reproduction and Growth.—They spawn in the late spring and early summer, some of them in the rivers, others probably at sea, although this has not been definitely ascertained. The European bass are said to deposit their spawn near the mouth of the rivers in the summer months.

From North Carolina to New Jersey the spawning time appears to be in May; in New Brunswick in June. Dr. Blanding many years ago

estimated the number of eggs at two million two hundred and forty-eight thousand. Their rate of growth is very rapid. Dr. C. C. Abbott, for five successive years, found in the Delaware River young an inch long in the second week in June. About the middle of October these had grown to the length of four and a half inches.

The young fish—five to nine inches in length—which are taken in such quantities in the Potomac in February and March, are supposed to be the young of the previous year. Captain Gavitt, of Westerly, Rhode Island, has caught bass in June that weighed from one half to one pound, put them in a pond, and taken them out in the following October, when they weighed six pounds. The average size of this fish probably does not exceed twenty pounds. In the Potomac, Hudson, and Connecticut Rivers the largest seldom exceed thirty or forty pounds, though in the Potomac fifty-pound fish are not unusual. The Fish Commission has for several years had a standing offer of a reward for a sixty-pound fish from the Potomac, but none has been forthcoming as yet. The largest Striped bass on record was one weighing one hundred and twelve pounds, taken at Orleans, Massachusetts, in the town cove. Such a fish would be at least six feet in length. A fairly proportioned bass thirty-six inches long would weigh at least eighteen pounds.

Uses.—The Striped bass is one of the most valuable of our food fishes, its flesh being firm, finely flavored, and hard enough to bear exposure to the air for some time without injury. It is also the most popular game fish, next to the salmon. Those in the markets are chiefly obtained in seines and traps, set at various points along the coast from the south side of Cape Cod to New Jersey. Great quantities are also taken in the shad seines in the spring. They may be readily taken, also, by heaving and hauling in the surf with menhaden bait, the fish being tolled by the use of great quantities of menhaden ground into small bits, and in fresh or brackish water by the use of the artificial fly. At various points on the coast of southern New England are club-houses, supported by wealthy amateurs for the purpose of carrying on these sports.

It has already been stated that the Striped bass are believed to be less abundant in the Gulf of St. Lawrence than in former years. Similar complaints are heard from the Bay of Fundy, and from Cape Cod, where the period of diminution is believed to date from the last advent of the Bluefish: about 1850. The bass fishery, in Cape Cod Bay, was formerly of great importance, but the capture of this fish is now of rare occurrence. The early settlers of New England seem to have been more impressed by the abundance of bass than by any other circumstances connected with the fisheries, and the early chronicles are full of allusions to their exceeding plenty and excellence.

Captain John Smith saw so many in one river, that he declared that he thought he might have walked across on their backs dryshod. While there can be no doubt that north of Cape Cod their numbers have decreased, there is no reason to believe that elsewhere on our coast the fisheries have had any especial effect upon them. A Hessian officer, writing in 1777, declared that enormous numbers were, at that time, brought to New York; and the same might be said at the present day. Three fishing gangs at Bridgehampton, New York, took over eight thousand in less than a week, in December, 1874. Captain Charles Ludlow secured at one set of his seine one thousand six hundred and seventy-two bass, or about three and a half tons. Shortly afterwards a

New London fisherman brought in four hundred and nineteen bass, one hundred and eighty-five of which had been caught with a hook in three hours, near Norfolk, Virginia. One thousand five hundred have been taken with a single set of the seine. A few years ago, it is said on credible authority that six hundred were once taken, the average weight of each being eighty pounds.

DISTRIBUTION OF FISH BY THE CALIFORNIA STATE FISH COMMISSION.

DISTRIBUTION OF TAHOE TROUT.

Distributed in September and October, 1888.

Localities and Remarks.	Number of Fish.
Squaw Creek	20,000
Lake Tahoe, at various points	245,000
Donner Lake	100,000
Dinkley and Buena Vista Creeks, Fresno County	30,000
South Fork of American River	20,000
Taylor Creek	25,000
Truckee River	105,000
South Yuba River	35,000
Shafer's Creek	7,000
Richardson's Creek	7,000
Barker's Creek and Lake	5,000
Gilmore's Lake	1,500
Watson's Lake	500
Total Tahoe trout (as reported by Mr. J. C. Frazier, October 27, 1888)	601,000

DISTRIBUTION OF SALMON.

Date.	Where Distributed and Remarks.	Number of Fish.
1888.		
Dec. —	McCloud River, from the United States Hatchery, by contract with Mr. Livingston Stone, at 75 cents per thousand	500,000

From Sisson Hatchery, for the Season of 1888–89.

Early Fall Run.

Date.	Where Distributed and Remarks.	Number of Fish.
1888.		
Dec. 23	Below Eighteenth Crossing, main Sacramento River	50,000
Dec. 24	Above Eighteenth Crossing, main Sacramento River	100,000
Dec. 25	Above Sullivan's, West Fork Sacramento River	100,000
Dec. 26	Near Stevens', West Fork Sacramento River	100,000
Dec. 27	West Fork Sacramento River	100,000
Dec. 28	Big Springs Creek, tributary Sacramento River	80,000
Dec. 29	Sulloway Creek, tributary Sacramento River	150,000
Dec. 30	Cold Creek, tributary Sacramento River	60,000
Dec. 31	Near Big Castle Creek, main Sacramento River	50,000
	Total	790,000

Late Fall Run.

Date.	Where Distributed and Remarks.	Number of Fish.
1889.		
Mar. 25	West Fork Sacramento River	156,000
Mar. 26	West Fork Sacramento River	144,000
Mar. 27	West Fork Sacramento River	72,000
Mar. 27	School House Spring Creek, tributary Sacramento River	144,000
Mar. 28	Big Spring and Sullivan Creeks, tributary Sacramento River	144,000
Mar. 28	Sulloway and Cold Creeks, tributary Sacramento River	104,000
Mar. 29	West Fork Sacramento River	144,000
Mar. 30	West Fork Sacramento River	144,000
April 3	Near Upper Soda Springs, main Sacramento River	84,000
April 4	Near Eighteenth Crossing, main Sacramento River	90,000
April 5	Near Mossbrae Falls, main Sacramento River	90,000
April 6	Near Mossbrae Falls, main Sacramento River	90,000
April 7	Near Dunsmuir, main Sacramento River	90,000
April 9	Near Lower Soda Springs, main Sacramento River	90,000
April 10	Near Little Castle Creek, main Sacramento River	90,000
April 11	Near Anderson's Mill, main Sacramento River	90,000
April 12	Three miles below Anderson's Mill, main Sacramento River	90,000
April 15	Near Big Castle Creek, main Sacramento River	90,000
April 16	Two miles below Big Castle Creek, main Sacramento River	90,000
April 17	Below Welsh's Mill, main Sacramento River	72,000
April 18	Below Eighteenth Crossing, main Sacramento River	60,000
	Total	2.168,000

DISTRIBUTION OF TAHOE TROUT.

From Tahoe Hatchery, 1889.

Date.	Applicant.	Where Distributed.	Number of Fish.
1889.			
Aug. 18		Blackwook Creek, tributary of Lake Tahoe	60,000
Aug. 24		Sea Gull Point, Lake Tahoe	35,000
Aug. 26		Near Saxon's Old Mill, Lake Tahoe	35,000
Aug. 27		At wharf, Tahoe City	20,000
Aug. 28		Off Island Ranch, Lake Tahoe	30,000
Aug. 29		Off Island Ranch, Lake Tahoe	40,000
Sept. 3		Meeks' Bay and Creek, Lake Tahoe	60,000
Sept. 3	Murphy Bros.	Small lake at the head of Meeks' Creek	8,000
Sept. 4	O. Roberts	Meeks' Bay, Lake Tahoe	60,000
Sept. 5	O. Roberts	Phipp's Creek, tributary of Lake Tahoe	60,000
Sept. 6	McKinney	Lake Tahoe, near Sugar Pine Point	60,000
Sept. 7	McKinney	Quail Creek, tributary of Lake Tahoe	60,000
Sept. 8	McKinney	In Lake Tahoe, near the snag	60,000
Sept. 10	M. Lawrence	Taylor Creek, tributary of Lake Tahoe	60,000
Sept. 13	M. Lawrence	Fallen Leaf Lake, tributary of Lake Tahoe	60,000
Sept. 14	Mrs. Vade Clark	Rubicon River, branch of Middle Fork of the American River	50,000
Sept. 17 and 18	Mrs. Kirby	Emerald Bay, Lake Tahoe	100,000
Sept. 18	M. Lawrence	Taylor Creek and Floating Island Lake	30,000
Sept. 20	A. J. Bayley	Burton Creek, tributary of Lake Tahoe	25,000
Sept. 23	A. J. Bayley	Truckee River, above Wardrusk Dam	60,000
Sept. 24		Blackwood Creek, tributary of Lake Tahoe	65,000
Sept. 27	Mr. Gilmore	Gilmore Springs, seven miles from Yank's	8,000
Sept. 29	Mr. Wentworth	Loon Lake and Buck Island Lake, headwaters Middle Fork American River	25,000
Oct. 2	A. L. Frost	Near Rubicon Point, Lake Tahoe	25,000
Oct. 5		Ward Creek, tributary of Lake Tahoe	20,000
Oct. 5	A. J. Bayley	Truckee River, below outlet of Lake Tahoe	6,000
Oct. 5	Com. Todman	Lake Tahoe, near Tahoe City	5,000
		Total	1,027,000

DISTRIBUTION OF SALMON.

From Sisson Hatchery for the Season of 1889 and 1890.

Early Fall Run.

Date.	Where Distributed and Remarks.	Number of Fish.
1890.		
Feb. 3	Cold Creek, tributary of Sacramento River	100,000
Feb. 4	Sulloway Creek, tributary of Sacramento River	100,000
Feb. 5	Cold Creek, tributary of Sacramento River	100,000
Feb. 6	Sulloway Creek, tributary of Sacramento River	100,000
Feb. 7	Big Spring Creek, tributary of Sacramento River	110,000
Feb. 8	School House Spring Creek, tributary of Sacramento River	180,000
Feb. 10	Sulloway Creek, tributary of Sacramento River	150,000
Feb. 12	Big Spring Creek, tributary of Sacramento River	100,000
	Total	970,000

Late Fall Run.

Date.	Where Distributed and Remarks.	Number of Fish.
1890.		
April 23	West Fork Sacramento River	80,000
April 25	West Fork Sacramento River	75,000
April 26	Upper Soda Springs, main Sacramento River	75,000
April 28	Near Dunsmuir, main Sacramento River	75,000
April 30	Near Eighteenth Crossing, main Sacramento River	45,000
	Total	350,000

DISTRIBUTION OF EASTERN BROOK TROUT.

Date.	Localities and Remarks.	Number of Fish.
1890.		
June 7	Deer Creek, east of Vina, Tehama County, California, for Senator Stanford	12,000
June 6	Headwaters McCloud River, Siskiyou County	24,000
June 8	Shovel Creek, branch of Klamath River, for A. C. Tubbs, Siskiyou County	4,000
June 9	Big Springs, branch of Shasta River, Siskiyou County	8,000
June 9	Griffen's Springs, branch of Shasta River, Siskiyou County	2,000
June 8	Wadsworth Springs, branch of Shasta River, Siskiyou County	1,000
June 8	School House Springs, branch of Sacramento River, Siskiyou County	2,000
June 19	Headwaters of Shasta River, branch of Klamath River, Siskiyou County	8,000
June 19	Kaiser's Springs, headwaters of Sacramento River, Siskiyou County	6,000
June 25	West Fork of Sacramento River, Siskiyou County	16,000
	Total Eastern Brook trout	83,000

DISTRIBUTION OF TAHOE TROUT.

From Tahoe Hatchery.

Date.	Applicant.	Where Distributed.	Number of Fish.
1890.			
July 28	Com. Todman	Truckee River, above Ward Rush Dam (Rainbow trout)	8,000
July 29	M. Lawrence	Taylor Creek, tributary of Lake Tahoe	60,000
July 31	M. Lawrence	Fallen Leaf Lake	56,000
Aug. 2	M. Lawrence	Taylor Creek and Cascade Lake	60,000
Aug. 4	Mrs. Kirby	Emerald Bay, Lake Tahoe	60,000
Aug. 5	A. L. Frost	Near Rubicon Point, Lake Tahoe	56,000
Aug. 6	Mrs. Vade Clark	Rubicon River, branch of Middle Fork of American River	50,000
Aug. 8		Meeks' Creek, tributary of Lake Tahoe	52,000
Aug. 9	O. Roberts	Phipps' Creek, tributary of Lake Tahoe	56,000
Aug. 11	J. McKinney	Quail Creek, tributary of Lake Tahoe	56,000
Aug. 12	J. McKinney	McKinney's Creek, tributary of Lake Tahoe	50,000
Aug. 19	Mr. Gilmore	Gilmore Springs, seven miles from Yank's (several small lakes)	35,000
Aug. 21		Blackwood Creek, tributary of Lake Tahoe	60,000
Aug. 22	J. McKinney	Loon Lake (15,000), Summit Lake (5,000), Quail Lake (5,000)	25,000
Aug. 23	M. Lawrence	South Fork American River, fourteen miles from Tallac	35,000
Aug. 25	Com. Todman	Truckee River, above Ward Rush Dam (Rainbow trout)	38,000
Aug. 26	J. Moody	Donner Lake	50,000
Aug. 26	J. Moody	Headwaters Alder Creek, near Truckee	8,000
Aug. 27	Mr. Scott	Squaw Creek, tributary of Truckee River	8,000
Sept. 14	Mr. Scott	Squaw Creek, tributary of Truckee River	10,000
Sept. 17	H. D. Burton	Carnelian Bay, Lake Tahoe	20,000
Sept. 23	A. J. Bayley	Burton Creek, tributary of Lake Tahoe	20,000
		Total Tahoe trout	873,000

DISTRIBUTION OF BLACK BASS.

Date.	Applicant.	Locality and Remarks.	Number of Fish.
1889.			
Aug. 12	Senator Jones	Thermalito Reservoir, at Oroville, Butte County, Cal.	60
Aug. 17	J. D. Jordan	Clear Lake, Lake County, Cal.	160
Aug. 25	J. D. Jordan	Clear Lake, Lake County, Cal.	160
Aug. 31	W. G. Dickinson	Sweetwater Lake, National City, San Diego County, Cal. (40 per cent lost)	120
1890.			
Aug. 12	Pacific Imp't Co.	In lake at Del Monte, Monterey County, Cal.	40
Aug. 12	Pacific Imp't Co.	Reservoir in Pacific Grove, Monterey County, Cal.	60
Aug. 22	O. Weissman	Blue Lakes, Lake County, Cal.	69
Aug. 29	J. D. Jordan	Clear Lake, Lake County, Cal.	88
Sept. 4	A. C. Bassett	Sargent's Station, Pajaro River, Santa Clara County, Cal.	40
Oct. 6	McD. R. Venable	City Reservoir, San Luis Obispo, San Luis Obispo County, Cal.	10
Oct. 6	McD. R. Venable	Laguna de San Luis, two miles west of San Luis Obispo City, San Luis Obispo County	50
		Total Black bass	857

DISTRIBUTION OF RAINBOW TROUT.

From Sisson Hatchery.

Date.	Name of Applicant.	Localities where Planted.	Number of Fish Shipped.
1890.			
July 15	Chas. Sonntag	Lagunitas Lake, Marin County	12,000
July 15		Lagunitas Creek, Marin Co., 5 miles below dam	8,000
July 20	S. V. W. Works Co.	San Mateo Ck., above reservoir, San Mateo Co.	40,000
July 23	J. B. Randol	Almanitos Creek, near New Almaden Mines, Santa Clara County	18,000
July 23	J. B. Randol	Guadalupe Creek, Santa Clara County	12,000
July 26	A. W. Ingalsbe	Smith's Creek, a branch of Calaveras Creek, Santa Clara County	12,000
July 26	A. W. Ingalsbe	Stevens' Creek, Santa Clara County	9,000
July 26	A. W. Ingalsbe	Saratoga Creek, Santa Clara County	9,000
July 30	Mr. Mendenhall	Arroyo Mocho Creek, Alameda County	18,000
July 30	Chas. Hadsell	Alameda and Calaveras Creeks, Alameda Co.	12,000
Aug. 3	J. R. Hebron	A branch of the Salinas River, Monterey Co.	12,000
Aug. 3	Chas. Romie	Arroyo Seco, branch of Salinas River, Monterey County	18,000
Aug. 11	John T. Doyle	Stevens' Creek, Santa Clara County	18,000
Aug. 11	John T. Doyle	Adobe Creek, Santa Clara County	12,000
Aug. 15	George Dennison	Boulder Creek, branch of San Lorenzo Creek, Santa Clara County	18,000
Aug. 15	George Dennison	Bear Creek, branch of San Lorenzo Creek, Santa Clara County	12,000
Aug. 19	F. Marriott	Los Gatos Creek, Santa Clara County	30,000
Aug. 23	J. G. Chesley	San Gregorio Creek, San Mateo Co. (⅓ lost)	30,000
Aug. 31	Dr. C. O. Dean	Paper Mill Creek, Marin County	30,000
Sept. 3	A. C. Bassett	In branches of Uvas Creek, Santa Clara Co.	30,000
Sept. 7	A. W. Stott	Sonoma Creek, Sonoma County	18,000
Sept. 7	T. Lake Harris	A branch of Russian River, near Santa Rosa, Sonoma County	12,000
Sept. 11	Dr. H. W. Smith	At Chili Bar, South Fork American River, El Dorado County	12,000
Sept. 11	Dr. H. W. Smith	At Moore's Bridge, South Fork American River, El Dorado County	3,000
Sept. 11	Dr. H. W. Smith	Near Dennis Johnson's, South Fork American River, El Dorado County	6,000
Sept. 11	Dr. H. W. Smith	Two Silver Creeks, branches of South Fork American River, El Dorado County	9,000
Sept. 18	C. F. Haswell	Cache Creek, near Ramsey, Yolo County	30,000
Sept. 23	F. L. Wooster	In branches of Napa Creek, near Napa, Napa Co.	30,000
July and Aug.	Edson Bros.	Shovel Creek, branch of Klamath River, Siskiyou County	130,000
Aug. 25		West Fork Sacramento River, Siskiyou Co.	25,000
Aug. 25		Sulloway Creek, branch of Sacramento River, Siskiyou County	25,000
Aug. 25		Cold Creek, branch of Sacramento River, Siskiyou County	15,000
Aug. 28		School House Creek, branch of Sacramento River, Siskiyou County	50,000
Aug. 28		In three creeks at Peter Klink's, branches of Sacramento River, Siskiyou County	50,000
Sept. 28		West Fork Sacramento River, Siskiyou Co.	50,000
Oct. 1		Near Dunsmuir, main Sacramento River	50,000
Oct. 2		Near Mossbra Falls, main Sacramento River, Siskiyou County	41,000
Oct. 3		Near Little Castle Creek, main Sacramento River, Siskiyou County	40,000
Oct. 6	McD. R. Venable	San Margarita Creek, branch of Salinas River, San Luis Obispo County	8,000
Oct. 6	McD. R. Venable	San Luis Creek, San Luis Obispo County	8,000
Oct. 6	McD. R. Venable	Chorro Creek, empties into Morro Bay, San Luis Obispo County	8,000
Oct. 6	McD. R. Venable	Laguna de San Luis, near San Luis Obispo City, San Luis Obispo County	10,000
Oct. 6	McD. R. Venable	Steiner and Venable Creeks, branches of San Luis Creek, San Luis Obispo County	3,000
Oct. 6	McD. R. Venable	Arroyo Grande, San Luis Obispo County	3,000
		Total Rainbow trout	996,000

DISTRIBUTION OF SALMON BY THE UNITED STATES FISH COMMISSION.

FROM MCCLOUD RIVER HATCHERY.

DATE.	Localities.	Number of Fish.
1888.		
Nov.,Dec.	McCloud River	1,000,000
1889.		
Nov.,Dec.	McCloud River	84,000
	Total salmon	1,084,000

DISTRIBUTION OF TROUT BY PRIVATE HATCHERIES IN 1890.

Kind of Fish.	Owner of Hatchery.	Place Planted.	Remarks.	Number of Fish.
Native trout	North Pac. Game and Fish Club	Sonoma Creek	From eggs taken from trout trapped in Sonoma Creek by permission of the California State Fish Commission	12,000
Rainbow trout	North Pac. Game and Fish Club	Sonoma Creek and Robinson Creek	From eggs shipped from the Shovel Creek Hatchery by the California State Fish Commission	90,000
Eastern Brook trout	North Pac. Game and Fish Club	Robinson Creek	(As reported by Mr. A. V. La Motte of the North Pacific Game and Fish Club)	25,000
Native trout	Alex. Badlam	Bear Creek	From trout trapped in Bear Creek, Napa County, by permission of the California State Fish Commission	15,000
Rainbow trout	Alex. Badlam	Sulphur Creek	From eggs shipped from the Shovel Creek Hatchery by the California State Fish Commission	20,000
Rainbow trout	Alex. Badlam	Lokonoma Creek	Near Middletown, Lake County, California	20,000
Rainbow trout	Alex. Badlam	Anderson Creek	Near Middletown, Lake County, California	20,000
Rainbow trout	Alex. Badlam	Grizzly Creek	Near Bradford's, Lake County, California	10,000
Rainbow trout	Alex. Badlam	Bradford Creek	Near Quicksilver Mine, Lake County, California	5,000
Rainbow trout	Alex. Badlam	Bear Creek	Near Areadia, Napa County, California	15,000
Rainbow trout	Alex. Badlam	Troutdale Creek	Near Areadia, Napa County, California (as reported by Mr. A. Badlam)	10,000
Rainbow trout	S. H. Knowles	Bear Creek, branch S. Lorenzo Creek	From eggs shipped from Shovel Creek Hatchery by California State Fish Commission	15,000
Rainbow trout	S. H. Knowles	In his private ponds	From eggs shipped from Shovel Creek Hatchery by California State Fish Commission	15,000
Rainbow trout	S. H. Knowles	Los Gatos Creek, Santa Clara Co.	From eggs shipped from Shovel Creek Hatchery by California State Fish Commission	10,000
Rainbow trout	Del Monte Hotel	Carmel River and reservoirs	From eggs shipped from Shovel Creek Hatchery by California State Fish Commission	40,000
			Total trout	322,000

RECAPITULATION.

Salmon distributed by California Fish Commissioners	4,478,000
Salmon distributed by United States Fish Commissioners	1,084,000
Eastern Brook trout distributed by California Fish Commissioners	83,000
Tahoe trout distributed by California Fish Commissioners	2,501,000
Rainbow trout distributed by California Fish Commissioners	996,000
Black bass distributed by California Fish Commissioners	857
Rainbow trout distributed by private hatcheries	322,000
Total	9,464,857
Salmon eggs in Sisson Hatchery October 15, 1890	3,000,000

THE FOOD FISHES OF THE CALIFORNIA FRESH WATERS.

By Dr. Carl H. Eigenmann.

The knowledge of the fresh-water fishes of California is at present more limited than that of any other State. It is, therefore, no easy task to present an account of the food fishes which shall at the same time be popular, or free from the technicalities of the ichthyologist, and scientifically exact. My personal observations have been confined to the southern and central counties of California, my explorations having been rather prematurely arrested. I hope, however, either this or the coming year to thoroughly explore every stream and lake in the State, and present you with a fuller report.

There is comparatively a very limited variety of fishes in California. A stream which, in the Mississippi Valley, would harbor seventy-five or a hundred different species of fish, would, in California, scarcely contain twenty. This is due to two causes.

CAUSES OF FISH SCARCITY.

I. Many of our streams become entirely dry during the summer, and no species that does not migrate to the sea or the lower or higher watercourses, can exist in them.

II. It is a law in the distribution of fresh-water fishes that the greater the water system the larger the number of species of fishes found in any of the tributaries. The tributaries of the Sacramento thus have much fewer species than the tributaries of the Mississippi, and the tributaries of the Mississippi much fewer than the tributaries of the Amazon. To be more precise, one naturalist has caught as many species of fishes in one of the tributaries of the Mississippi in a day as there are known from the entire region west of the Sierra Nevada.

NAMES OF FISHES.

I present a list of the fresh-water fishes now known from California, giving both the scientific and popular name:

Ammocœtes tridentatus Gairdner. Lamprey.
Ammocœtes cibarius Girard. Lead-colored Lamprey.
Acipenser transmontanus Richardson. White Sturgeon.
Acipenser medirostris Ayers. Green Sturgeon.
Catostomus arœopus Jordan. Kern River Sucker.
Catostomus rex R. Eigenmann. Klamath Sucker.
Catostomus occidentalis Ayers. Sacramento Sucker.
Catostomus tahoensis Gill and Jordan. Tahoe Sucker.
Chasmistes brevirostris Cope.
Chasmistes luxatus Cope.
Orthodon microlepidotus Ayers.
Lavinia exilicauda Baird and Girard.
Pogonichthys macrolepidotus Ayers.
Mylocheilus caurinus Richardson.
Mylopharodon conocephalus Baird and Girard.
Ptychocheilus oregonensis Richardson. Sacramento Pike.

Ptychocheilus rapax Girard.
Ptychocheilus harfordi Jordan and Gilbert. Sacramento Pike.
Phoxinus montanus Cope.
Phoxinus orcuttii E. and E.
Phoxinus conformis Girard.
Phoxinus bicolor Girard.
Phoxinus obesus Girard.
Phoxinus crassicauda Baird and Girard.
Phoxinus crassus Girard.
Phoxinus cæruleus Girard.
Algansea dimidiata Cope. Chub.
Algansea symmetrica Baird and Girard.
Algansea bicolor Girard.
Luxilinus occidentalis Baird and Girard.
Coregonus williamsoni Girard. Whitefish.
Oncorhynchus gorbuscha Walbaum. Humpback Salmon.
Oncorhynchus keta Walbaum. Dog Salmon.
Oncorhynchus tchawytcha Walbaum. Quinnat Salmon.
Oncorhynchus kisutch Walbaum. Silver Salmon.
Salmo gairdneri Richardson. Steel-head Salmon.
Salmo gairdneri irideus Ayers. Brook Trout.
Salmo purpuratus Pallas. Oregon Brook Trout.
Salmo purpuratus henshawi Gill and Jordan. Tahoe Trout.
Salvelinus malma Walbaum. Dolly Varden.
Gasterosteus williamsoni Girard. Stickleback.
Gasterosteus microcephalus Girard. Stickleback.
Archoplites interruptus Girard. Sacramento Perch.
Cottus asper Richardson.
Cottus semiscabrus centropleurus E. and E.
Cottus gulosus Girard.
Cottus minutus Pallas. "Catfish."

By saying that the number of species of fresh-water fishes is limited, I do not wish to imply that the food fishes are less in number or inferior in quality, but merely that we have less variety, a defect which can be remedied by introducing other species.

DESIRABLE SPECIES TO IMPORT.

The most prominent food fishes of the Mississippi Valley which are not indigenous to California, are the various catfishes, the buffalo, the pickerels, most of the sunfishes, especially the Black bass, the perches, and the bass. Several of these have already been introduced.

In the southern part of the State, where all but the mountain sources of the rivers dry up during the summer, we naturally have but few fresh-water fishes, and any attempts to stock these rivers are, of course, futile. There are but four different species of fishes in the fresh waters of San Diego County, exclusive of the Colorado River. One is a small killifish living in the hot springs of the Colorado Desert, another a small stickleback, a third a small minnow, while the only eatable fish is the *Salmo irideus*, which occurs, as far as known, only in Pala Creek. There is scarcely more variety till we reach the Tulare Basin. *Salmo irideus*, or the Brook trout, is the only food fish south of the Tulare Basin, and it never reaches a large size there. A few species of marine fishes run up the Southern California streams during spring. Chief of these is the mullet. When the dams of the Sweetwater reservoirs were opened, to clear part of the land of the water, large numbers of Sea bass ascended the stream thus formed. With these remarks Southern California may be dismissed.

The remainder of California may be divided into the Tulare, Sacramento, Klamath, and Tahoe regions, each of which has a different set of food fish. They are:

Tulare Region.	Sacramento Region.	Klamath Region.	Tahoe Region.
Kern River sucker.	White sturgeon. Green sturgeon. Sacramento sucker. Salmon. Brook trout. Salmon trout.	White sturgeon. Green sturgeon. Three species of suckers. Salmo purpuratus. Salmon trout. Dolly Varden.	Tahoe sucker. Tahoe trout. Whitefish. Chub.

There are besides these a number which are found in several of these systems. The trouts and suckers are, however, different for each system. Taking up the different species used for food separately:

Acipenseridæ, or Sturgeon.

The sturgeons are among the largest of the fresh-water fishes. Like the salmon they spend some of their time in the bays and ocean, and ascend the streams to spawn. There are two species found on the Pacific Slope, to which they are confined, those in the eastern rivers being quite distinct.

Acipenser transmontanus Richardson. White Sturgeon.

This sturgeon is said to reach a weight of six hundred pounds. It is almost daily brought into the San Francisco markets. Those offered for sale vary from two to seven feet in length. It is said to reach a length of twelve feet. It is sold in the restaurants as "tenderloin of sole." Large numbers enter all of the large streams from the Sacramento to the Frazier River.

Acipenser medirostris Ayres. Green Sturgeon.

This species is much rarer than the White sturgeon, but is not infrequently brought into the markets. It reaches as large a size as the preceding. The young of these two sturgeons differ greatly from the adult, and the young of the two species are not distinguished in the fish stalls. Dr. Jordan said ten years ago, that this sturgeon was reputed poisonous and not used for food. Although it is still looked upon with less favor than the White, or *the* sturgeon, it is no longer considered poisonous. This property is now ascribed to the young of this or of both species. The old can readily be distinguished from the White sturgeon by its rough skin and by the green band along the belly.

Catostomidæ, or Suckers.

The sucker is almost entirely a North American product; of the many species only two are found elsewhere. The suckers found in California are all species peculiar to the western slopes of America. The Buffalo fishes, which belong to this family, are not found on the Pacific Slope. All the species are more or less valuable as food. The California suckers all belong to the genera *Catastomus* and *Chasmistes*, and each river system has one or more which is peculiar to it. The majority ascend small streams in spring to spawn.

Catastomus arræopus Jordan. Kern River Sucker.

This is a small sucker, about thirteen inches long. Very little is known about it as yet.

Catostomus rex R. Eigenmann.

This sucker, reaching a length of three feet, is abundant in Tule Lake, and ascends the Lost River.

A specimen has lately been procured for the Academy of Sciences, through the kindness of Mr. Woodbury, of the Fish Commission.

Catostomus occidentalis Ayers.

This is the common Sacramento sucker, or "the sucker" of the San Francisco market. It is abundant in the whole Sacramento Valley, and descends some distance into tide water. I have taken it at Mare Island. It is not greatly esteemed as food.

Catostomus tahoensis Gill and Jordan. Tahoe Sucker; Red-sided Sucker; Black Sucker.

This sucker is found in the Truckee Basin. It ascends the rivers and rivulets tributary to Lakes Tahoe and Donner in June to deposit its spawn. The very young of this species are quite black; the half grown have a bright red stripe along the sides. In the early part of June these half grown ascend the small rivulets in such abundance that the Indians and others catch large quantities by placing a sack across one of the streams and then driving them down. The larger ones have the red lateral stripe less conspicuous than the half grown. They ascend the rivers at the time the young ones ascend the rivulets. In June none were seen in Lake Tahoe, and but few were being taken in Donner Lake. A few were taken in the Fish Commission's traps in June, and great quantities were seen in Donner Creek, especially in all deep holes.

Chasmistes brevirostris Cope.

This is a small sucker, reaching the length of sixteen inches. It is abundant in Klamath Lake, but does not ascend Williamson's River in spring.

Chasmistes luxatus Cope.

This sucker is also found in Klamath Lake, but reaches a much larger size, nearly three feet. "It ascends the streams in thousands in the spring, and is taken and dried in great numbers by the Klamath and Modoc Indians."

CYPRINIDÆ. The Carps or Minnows.

The American members of this family are mostly small, bony fishes, not fit for food. In the waters of the western slopes some of them attain a large size, however, the Sacramento pike reaching a length of five feet. They are usually very abundant where they are found at all, and form an important item of the food of larger fishes. The most important member of the family is the German carp, a native of Central

Asia, which has been copiously introduced into Europe and America. A large number of the species found in California are more or less valued as food, and are at times brought to the San Francisco markets.

Orthodon microlepidotus Ayres.

This is a small species, reaching a length of fourteen inches. It is abundant in the Sacramento, and is occasionally found in the San Francisco markets.

Lavinia exilicauda Baird and Girard.

This species resembles the preceding in size and distribution.

Pogonichthys macrolepidotus Ayres. Split-tail.

This is one of the commonest of the minnows. It is at once recognized by its widely forked tail.

Mylophardon conocephalus Baird and Girard.

This is one of the largest of the *Cyprinidæ*. It is said to reach a length of eighteen inches. It is rarely brought to the San Francisco market.

Ptychocheilus oregonensis Rich., and *harfordi* J. and G. Sacramento Pike; Whitefish.

There are two varieties of pike brought to the markets, but they are not distinguished by the fishermen. They are called pike from their resemblance to the true pike, from which they are, however, quite distinct, and to which they are not at all related. *P. oregonensis* is said to reach a length of five feet.

Salmonidæ. Salmons, Trouts, and Whitefish.

The *Salmonidæ* embrace the most important of our fish, both as regards food and sport. The genera which in California are of greatest value are *Coregonus*, *Oncorhynchus*, *Salmo*, and *Salvelinus*. They can readily be distinguished from our other fresh-water species by the adipose fin, and by the presence of scales. The genera found in California may be distinguished by the following characters:

a. Jaws toothless; scales rather large; habitually living in fresh water ---------- *Coregonus*, or Whitefish.
aa. Jaws with distinct teeth.
b. Anal fin elongate; fourteen to seventeen rays, the tip of the highest ray rarely extending beyond the base of the last ---------- *Oncorhynchus*, or salmon.
bb. Anal fin shorter; of nine to eleven developed rays.
c. Vomer flat; its toothed surface plane; teeth on its shaft in pairs, or in a zigzag row; tip of the highest anal ray usually extending beyond the tip of the last ray ---------- *Salmo*, or trouts.
cc. Vomer boat-shaped; its shaft strongly depressed; teeth on chevron only ---------- *Salvelinus*, or Charrs, or Brook trouts.

Unfortunately there is a confusion of names due to localities and variation in the species of this family which is frequently misleading. To this is to be added that very little is known as yet concerning the California trouts, so that many writers, basing their remarks on a few pickled specimens, have increased the confusion rather than helped us.

To this must also be added that the excellent figures accompanying many of the reports, and which pretend to give the differences, are based on specimens which differed widely in size, and are therefore misleading. This last fact has undoubtedly much to do with the confusion existing in regard to the Steel-head trout and Brook trout.

The discussions whether a given fish may be a trout or Salmon trout, while edifying to the man talking or writing, does not help us in the least to clear this matter.

In this connection it may be worth our while to examine the remarks of Dr. Günther on the variability of the species of the genus *Salmo*, remarks which Dr. Jordan had occasion to quote when studying these same fishes:

There is no other group of fishes which offers so many difficulties to the ichthyologist, with regard to the distinction of species, as well as to certain points in their life history, as this genus.

The almost infinite variations of these fishes are dependent on age, sex, and sexual development, food, and the properties of the water. * * * The *coloration* is, first of all, subject to variation, and consequently this character but rarely assists in distinguishing a species, there being not one which would show in all stages of development the same kind of coloration. The young of all the species of this genus are barred, and this is so constantly the case that it may be used as a generic, or even as a family character, not being peculiar to *Salmo* alone, but also to *Thymallus*, and probably to *Coregonus*. The number of bars is not quite constant, but the migratory trout have two (and even three) more than the river trout. When the salmons have passed the "parr" state, the coloration becomes much diversified. The males, especially during and immediately after the spawning time, are more intensely colored and variegated than the females, specimens which have not attained to maturity retaining a brighter silvery color, and being more similar to the female fish. Food appears to have less influence on the coloration of the outer parts than on that of the flesh; thus, the more variegated specimens are frequently out of condition, whilst well fed individuals, with pinkish flesh, are of a more uniform, though bright coloration. Chemistry has not supplied us yet with an analysis of the substance which gives the pink color to the flesh of many salmonoids; but there is little doubt that it is identical with, and produced by, the red pigments of many salt and fresh-water crustaceans which form a favorite food for these fishes. The water has a marked influence on the colors. Trout with intense ocellated spots are generally found in clear, rapid rivers, and in small, open, alpine pools; in the large lakes, with pebbly bottom, the fish are bright-silvery, and the ocellated spots are mixed with, or replaced by, X-shaped black spots; in pools or parts of lakes, with muddy or peaty bottom, the trout are of a darker color generally, and when inclosed in caves or holes they may assume an almost uniform blackish coloration. The brackish, or salt water, has the effect of giving them a bright-silvery coat, without or with comparatively few spots, none of which are ocellated. * * *

With regard to *size* the various species do not present an equal amount of variation. Size appears to depend on the abundance of food, and the extent of water. Thus, the salmon and the different kinds of Great Lake trout do not appear to vary considerably in size, because they find the same conditions in all the localities inhabited by them. * * * * * * * * * * * * * * * * * *

The *proportions of the various parts of the body to one another* vary exceedingly in one and the same species. * * * The *fins* vary to a certain degree. * * *

Finally, to complete our enumeration of these variable characters, we must mention that in old males, during and after the spawning season, the *skin* on the back becomes thickened and spongy so that the scales are quite invisible, being imbedded in the skin.

Coregonus williamsoni Girard. Whitefish.

This fish is abundant in Lake Tahoe. It spawns in October and November in the tributaries of the lake. During the remainder of the season the adult is probably found in deep water. In June, schools of individuals, nine inches long, were seen on the eastern shores of the lake. In the evening when swarms of gnats were blown into the lake these Whitefish rose to them. A few were caught at the time with small hooks baited with fly. It reaches a length of nearly fifteen inches, and weighs about a pound. It ranks high as a food fish. Mr. Henshaw says of it:

At Lake Tahoe it was found very abundant in October, being met with at that season in all the few streams that rise from the lake. * * * This month, and later, is

their spawning season, and as they pass up many are intercepted by the Indians, who find a market for considerable numbers in the settlements and logging camps about the lake. Having constructed a suitable net of mosquito netting, which is affixed to a long pole, the Indian, accompanied by one or two squaws, proceeds to the stream where it is sufficiently narrow for his purpose. Placing the net at the head of one of the deep sandy-bottomed pools which are found at every turn of the stream, he awaits quietly till all the fish near by have been frightened into it by the squaws, who advance from below, and beat the water with sticks. With a sudden scoop he usually empties the pool, taking perhaps from six to a dozen fish from each. All that we saw caught in this manner were quite small, averaging perhaps ten inches in length, but they attain a much larger size.

Oncorhynchus. Pacific Salmon.

The members of the genus *Oncorhynchus* are confined to the North Pacific and the rivers flowing into it. They are generally termed salmon without distinguishing them from one another, or from the salmon of New England and Europe. They are by far the most important food fishes, and the Quinnat salmon probably surpasses in value all of our other fresh-water fishes combined.

Four of the five species known are found in the Sacramento; one of these is, however, only occasionally taken.

All of these species live in the sea, and ascend the rivers only at the spawning season. The Quinnat salmon enter the Sacramento in the spring and summer, and the run ceases, according to Jordan, in October. The larger individuals enter the river first, and the smaller ones, two feet long, do not run till July and August. Jordan says:

> The spring salmon ascend only those rivers which are fed by the melting snows from the mountains, and which have sufficient volume to send their waters well out to sea. Such rivers are the Sacramento, Klamath, * * * etc.
>
> Those salmon which run in the spring are chiefly *adults* (supposed to be at least three years old). Their milt and spawn are no more developed than at the same time in others of the same species which will not enter the rivers until fall. It would appear that the contact with cold fresh water when in the ocean, in some way caused them to turn toward it and to "run" before there is any special influence to that end exerted by the development of the organs of generation.
>
> High water on any of these rivers in the spring is always followed by an increased run of salmon. * * * The average weight of the Quinnat in the Sacramento in the spring is sixteen pounds.
>
> Those fish which enter the rivers in the spring continue the ascent until death or the spawning season overtakes them. Probably none of them ever return to the ocean, and a large proportion fail to spawn. They are known to ascend the Sacramento as far as the base of Mount Shasta, or to its extreme headwaters—about four hundred miles.
>
> At these great distances, when the fish have reached the spawning grounds, besides the usual changes of the breeding season, their bodies are covered with bruises, on which patches of white fungus develop. The fins become mutilated, their eyes are often injured or destroyed, parasitic worms gather in the gills, they become extremely emaciated, their flesh becomes white from the loss of oil, and as soon as the spawning act is accomplished, and sometimes before, all of them die.

Dr. G. Brown Goode says of this fish:

> Fifty years ago it was hardly known, except to students of natural history. Now it is known and eaten almost all over the world, for there is hardly a port in the world where ships have not carried the canned salmon of the Columbia, which is the same fish under a different name; and not only has this fish, in the form of food, traveled nearly all over the world, but the living embryos of the California salmon have been transported to England, France, Germany, Belgium, Denmark, Russia, Australia, and New Zealand, so that there is probably no one fish inhabiting a limited locality which is known over the world in so many different places as the California salmon.

The four species of *Oncorhynchus* found in the Sacramento are distinguished by the following characters:

a. Scales small, lateral line more than 200 ..... *Gorbuscha*.
aa. Scales large, lateral line 125–155.
b. Pyloric cœca 50–80; lateral line 125–135 ..... *Kisutch*.

bb. Pyloric cœca 140 or more.
c. Anal rays 13–14; branchiostegals 13–14 ..... *Keta.*
cc. Anal rays 16; branchiostegals 15–19 ..... *Tchawytcha.*

Oncorhynchus gorbuscha Walbaum.

This, the Humpback salmon, is only occasionally taken in the Sacramento and Columbia. It runs every other year in Puget Sound. It reaches a weight of three to seven pounds.

Oncorhynchus kisutch Walbaum. Silver Salmon.

This salmon runs in the Sacramento in summer and fall; it does not exceed eight pounds in weight, and many are doubtless confounded with the young of the Quinnat. From this they are, however, readily distinguished by the number of cœcal appendages about the stomach, which scarcely exceeds seventy-five in this species, while there are more than one hundred and twenty-five in the Quinnat. Mr. Chas. Ohm took the young of this species, five and seven eighths inches long, in Paper Mill Creek, on March 24, 1890.

Oncorhynchus keta Walbaum. Dog Salmon.

I have not yet seen any fresh examples of this species. It is said to be abundant in the fall from the Sacramento northward, when it ascends all the streams for a short distance. It does not begin to "run" until its sexual organs are well advanced in development and its flesh proportionately deteriorated. For this reason it is of no great economic value.

Oncorhynchus tchawytcha Walbaum. Quinnat Salmon.

This is the salmon par excellence, and, like *Salmo salar*, "stands pre-eminent, like a Highland Chieftain, needing no name save that of his clan." It is still "The Salmon," "Quinnat Salmon;" and "King Salmon" when ready to be eaten, "Columbia Salmon" or "Alaska Salmon."

What I have said under the head of the genus *Oncorhynchus* in general applies to this species especially. I have caught the very young of this species (about two inches long) at Mare Island, on April 17, 1890.

SALMO.

The species of this genus are variously named by the fishermen. The young taken in the mountain streams are all Brook trouts, or Rainbow trouts; the old ones are Trout, Steel-head, Salmon trout, and even Salmon, and a special series of names has been invented in Lake Tahoe.

It is concerning the members of this genus that there was such discussion in the papers during last spring. For practical purposes, all the species of this genus may be classed as one, and covered by a general law protecting trout. All the rules of the angler will not suffice in distinguishing the species, and such practical experiments as scraping the scales with the thumb nail to distinguish Brook trout from Salmon trout, are perfectly useless. Every angler knows how variable the trouts are in the different streams and ponds, and Dr. Günther's words, quoted above, are but the expression of the experience of every naturalist, as well as of every angler. Through the courtesy of Mr. Charles Ohm, I

have been able to examine about seventy-five Brook trouts from different streams, and others have come into my hands from Mr. Belding. Although the alcohol has obliterated most of the color markings, it can still be seen that no two streams have trout with exactly the same characters. To add to the confusion, the young of the salmon greatly resemble the trouts, and the old trouts greatly resemble the salmon. Young salmon have been brought to me as Brook trouts; and I bought a splendid Brook trout, nineteen inches long, which the fish dealer declared was a salmon, and willing to prove it by as large a bet as I would name.

I do not know where trouts have been planted, and where those so planted were procured, but the native species are distributed as follows:

1. The Brook trout, or Rainbow trout (*Salmo gairdneri irideus* Gibbons), in all mountain streams west of the Sierra Nevada from Mount Shasta to Lower California.

2. The Steel-head (*Salmo gairdneri* Richardson), from the Sacramento northward.

3. The Northern trout (*Salmo purpuratus* Pallas), from Mount Shasta northward.

4. The Tahoe trout (*Salmo purpuratus henshawi* Gill and Jordan), in the Truckee Basin, including Lakes Tahoe, Donner, Pyramid, and possibly Eagle.

It is thus seen that three of the trouts inhabit contiguous territory, while the other, the Steel-head, overlaps the territory of two of the species. There are, however, so many forms which are intermediate between the Brook trout proper and the Steel-head that the former may be looked upon as simply a southern form of the latter, or, conversely, the latter a northern form of the former.

These species and varieties are extremely hard to distinguish unless specimens of the same size are at hand. They may be determined by the following technical characters arranged by Dr. Bean:

a. No hyoid teeth.
  b. Anal rays, 12; depth of body equals length of head in young; tail of adult truncate ..... *S. gairdneri;* Steel-head.
  bb. Anal rays, 10; depth of body much exceeds length of head in young; tail of adult forked ..... *S. gairdneri irideus;* Brook, or Rainbow trout.
aa. Hyoid teeth.
  c. Head short; scales, not more than 170; gill rakers, 8–12; cœca, 20..... *S. purpuratus;* Northern trout.
  cc. Head long, conical; scales, sometimes 184; gill rakers, 9–14; cœca, 50–60 ..... *S. purpuratus henshawi;* Tahoe trout.

Salmo gairdneri Richardson. Steel-head Salmon.

This trout is not infrequently brought into the San Francisco market during the close season. At other times it is not so abundant, and in summer and fall it is rarely seen. It reaches a weight of twenty pounds. The California Academy of Sciences possesses a large specimen, the gift of Mr. Charles Ohm. It measures two feet five inches in length, and is a spent male.

There are several others smaller than this in the Academy's collection, presented by the same gentleman. It is more slender than the Rainbow trout or the Quinnat salmon, and does not ascend streams to any great distance.

Very little or nothing is known of the habits and life history of this species, and any notes on its migration, etc., ought always to be kept.

The young have very rarely been found, a fact which has led many to believe that the Brook trout are only the young of this species, especially as the latter are always, or usually, found in abundance in the same streams.

Salmo gairdneri irideus Gibbons.

This is the Rainbow or Brook trout proper. It is also known by various other names. There is no difficulty in distinguishing the adult of this species from the adult of the Steel-head, but the half grown are remarkably alike, and intergradations of all sorts are abundant. It does not attain nearly the size of the Steel-head, the largest recorded weighing but six pounds. These large examples are very rare. I have seen only one in the markets of San Francisco, and, as I have stated above, this was represented to be a young salmon.

The young are caught in large numbers in all the trout streams in Central and Southern California. It probably does not enter salt water as readily as the Steel-head, but it probably runs into the sea from short rivers which are dry in summer, and from others having a continuous stream of clear water.

It is a most excellent table fish, but not caught in quantity for the market. Its chief value seems to be to offer sport to anglers, and this is said to be of a very tame kind. It has been extensively introduced and seems to flourish in many eastern streams. Specimens have been taken in salt water near Oakdale, Long Island.

It varies more in size, color, etc., with the stream it inhabits than any other fresh-water fish.

Mr. Henshaw says of this species:

This is the common Brook trout of the small mountain streams of the Pacific Slope, and up to an altitude of nine thousand feet it is the rare exception to find a suitable stream that is not well stocked with it. Upon many of them, as the tributaries of the South Fork of the Kern River, these trout are found in very great abundance, each pool and rapid numbering its finny denizens by the score. They may be taken in any sort of weather, at any hour of the day, by almost any kind of bait. During the heat of the day they frequent almost entirely the deeper pools, lying under overshadowing rocks or in the shade of some convenient log. In early morning or late afternoon they come out and run more into the shallows and rapids, under which circumstances they bite best and afford the finest sport. Like the average Brook trout the species rarely attains any considerable size, ranging from four to eight or more inches in length. Their colors are usually very bright, and for beauty this species takes rank among the foremost of its kind, and has well been called the Golden trout. In this respect, however, it is subject to the usual variation obtaining in the family, the change of color not only accompanying a difference in locality, but being plainly discernible in individuals taken in different parts of the same stream not far distant. In fact, as a specific character, color in this family seems to be at its lowest value. The character of the bottom and water itself has much to do with this, and I remember to have fished in a small rivulet on one of the subalpine meadows not far from Mount Whitney, whose sluggish waters flowed over a bottom of dark mud, in which the color of the trout simulated very closely its hue; they had lost nearly all the flashing iridescent tints characterizing the same species caught but a few hours before in another stream, and had become dull and somber-hued. Accompanying this change of color was a correspondingly noticeable difference in the habits and motions, and the several dozen trout caught that evening for supper were taken out by the hook with the display of very little more gaminess than would be noticed in so many Horned pout. On the contrary, in the clear rapid current of the mountain stream, a flash of sunlight is scarcely quicker than the gleam of gold and silver, seen for a single instant, as the whirling waters are cut by one of the trout as he makes a rush from his lurking place for some chance morsel which is being borne past him. The western trout are rarely as shy as their relatives of eastern waters, and because of their numbers and consequent scarcity of food are apt to be less fastidious; yet even when most abundant due caution must be used if one would be successful, and not every one can catch trout even in the West. With the proper care in concealing one's self a pool may be almost decimated ere the alarm will be taken, and I have seen fifteen fair sized trout taken from a single small pool in quick succession.

Salmo purpuratus Pallas. Oregon Brook Trout; Salmon Trout; Lake Trout.

I know nothing personally of this fish. It "is very abundant in all the waters north of Mount Shasta, and through the Great Basin and Rocky Mountain region; occasionally southward to Santa Cruz." It seems to have skipped California, except some parts of it; is found in abundance to the north of us, and extends farther south than any other salmon, having been "obtained by Professor Lufton from streams of the Sierra Madre, Mexico, at an elevation between eight and nine thousand feet in the southern part of Chihuahua, near the boundaries of Durango and Sinaloa." It occasionally reaches a weight of twenty-five pounds in the Columbia. These large ones are known as Steel-head, the young as Brook trout, and the partly grown as Salmon trout. It is of considerable importance economically, and its introduction into all streams suitable to it is to be recommended.

Salmo purpuratus henshawi Gill and Jordan.

This, the Lake Tahoe trout, is of greater economic importance than the others. It is abundant in the San Francisco markets all through spring. The fishermen of Lake Tahoe keep their catch alive till they have a sufficient number to warrant a shipment, when they are killed, boxed, and shipped to San Francisco. The past year one company had the entire control of the Tahoe catch.

This fish is known under various names to the fishermen and anglers of Lake Tahoe, who consider the variations, due to age, sex, depth of water, and character of bottom, all of specific value. If we keep in mind, however, the statements made by Dr. Günther, all the variations can easily be explained. The trout reported to me while at Lake Tahoe last June were: First, the Big Black trout, reaching a weight of twenty-nine pounds, and spawning in the rivers in April and May. Second, the Red trout, probably not exceeding a weight of seven pounds, which spawns in the streams from May to the first of August. Third, the Pogy or Porgy, weighing one and a half to two pounds, and spawning the latter part of August and during September. Fourth, the Silver trout, reaching nearly seventeen pounds in weight, and spawning in the lake in October and November. Fifth, the Yellow Belly or Sulphur Belly, the time and place of spawning not determined. Sixth, the Brook trout, found in the streams about Lake Tahoe.

In this connection I can but quote, with slight modification, what we have said elsewhere—"San Francisco Chronicle," August 31, 1890:

The so called Big Black trout we did not see. The eggs of this large trout are larger than those of the Red trout, and grayish in color; the young are also gray. The eggs and young of the Red trout are almost cherry red, and the pigment of the young, reared in the hatchery, is much more developed than in those of the big trout. The facts brought to our notice would seem to indicate that the big trout is a species distinct from the Red trout. It would not, however, be surprising if this should prove to be only the adult form of the Red trout. The difference in the size of the egg, and in the time of spawning, is not without its parallel in sea fishes, and the difference in color is, as we have seen, easily accounted for.

The Red trout has meat of a light pink color. The branchiostegal membrane is bright red. The females which have deposited their ova are quite silvery, while the males which have spawned are of a dark cherry color on the sides, darker above and lighter below. All the numerous individuals seen were pretty uniformly spotted.

The Porgy is unquestionably the young Red trout during its first spawning season. "It is so fat that it may be fried in its own grease." The later time of spawning is readily accounted for by the youth of the Porgy, while its place of spawning (in the lake) is made

a necessity by the fact that, in all but unusually late seasons, like the present, the streams emptying into the lake become dry by the time this fish is ready to spawn. In color the Porgy is intermediate between the male and female trout, but the spots are much less regular.

The Silver trout may readily be distinguished at a glance in life, but the Porgy is readily taken for a Silver trout when life is extinct. Two Porgies purchased at the wharf of Tahoe City appeared to be Silver trout when they reached our hotel. The meat is of a salmon color. Many of the Silver trout are, without any doubt, the Red trout at a stage younger than the Porgy. If the assertion be true, that the Silver trout attains a weight of seventeen or eighteen pounds, the lack of color is doubtless due to the surroundings.

The Yellow-belly is a Silver trout from a different bottom, which has changed the silvery to yellow.

The Brook trout of this region are merely the young of the Red trout. They are quite distinct from the true Brook trout (*Salmo irideus*).

It will thus be seen that the trout of Tahoe belong at most to only two species, and very possibly to a single one.

At the fish hatchery of the State Fish Commission, located at Tahoe City, thousands of trout are now being hatched. The troughs at the hatchery are filled with the trout in all stages of development, from the currant-like egg to the food-hunting fish an inch long, which has lost its yolk-sac, or source of nourishment.

Salvelinus malma Walbaum. Dolly Varden; Red-spotted Trout.

This is another species concerning which I have no personal knowledge. It is indigenous to the region west of the Cascade Range, from Northern California to Alaska. According to Goode it is the most important of our chars, next to the Eastern Brook trout. It descends to the sea, and reaches the weight of fourteen pounds, but in the mountain streams it spawns at a length of six or eight inches. They are reported to spawn late in the fall in the rivers.

CENTRARCHIDÆ. The Sunfishes.

Archoplites interruptus Girard. Sacramento Perch.

This is the only California representative of the numerous species of sunfishes inhabiting North America. It is found throughout the Sacramento and San Joaquin Valleys, and descends to tide water. It is not frequently brought into the market, and is of no great economic value.

HOLCONOTIDÆ. Viviparous Perches.

Hysterocarpus traski Gibbons. Viviparous Perch.

The economic value of this fish is entirely incommensurate with its scientific interest. It does not reach a large size. It is found throughout the Sacramento Valley. It is the only American fresh-water representative of the viviparous family *Holconotidæ*, of which there are so many species along the entire coast of California. While all our other fresh-water fishes deposit spawn, this species brings forth living young in an almost mature stage.

Its characters have been so changed, probably by its permanent stay in fresh water, that it now represents a sub-family quite distinct from its marine relatives.

COTTIDÆ. Sculpins.

The members of this family are mostly marine, and species of *Cottidæ* abound along the entire coast of California. Some of them reach a large size, and are brought into the markets; but most of them are small and of no importance.

COTTUS. Bullheads; Miller's Thumbs.

The remaining species of fresh-water fishes are all small, and only indirectly of economic interest. Our account of the one found at Lakes Tahoe and Donner will serve for them all.

Large individuals (about seven inches is large for this fish) are especially abundant near the hatching house of the Fish Commission, where the dead trout eggs are thrown each day. A handful of trout eggs is certain to bring a bullhead from under every stone in the vicinity. This fish is related to the *Oligocottus analis*, a marine species of bullhead living in tide pools on the coast of California, which changes, according to food and surroundings, from a grass-green to gray of various patterns. The changes in color of *Cottus minutus* are no less striking. Over a muddy bottom this species is quite black, assuming a drab or "sand color" over sandy bottom; while over rocks and pebbles it is conspicuously banded with light and dark. The bullheads are very destructive to the trout. They lie in wait for them at the mouths of creeks for the descent of the young ones. The bullheads, in their turn, form the principal food of a species of *Eutenia*, abounding on the shores of the lake.

WHY SALMON ARE SCARCE.

LETTER FROM DR. H. W. HARKNESS, PRESIDENT OF THE CALIFORNIA ACADEMY OF SCIENCES.

Upon reëxamining the subject, with the view of determining the cause for the scarcity of salmon in our rivers, we find that the principal agent engaged in their destruction is man.

Man accomplishes this in various ways — by the fouling of the rivers by manufactories, by dams or other obstructions, and chiefly by seine fishing.

The modern appliances are so perfect, and the pursuit of fish so active and persistent, that we are convinced that should the fishermen comply with the law in every particular, even then the salmon would disappear altogether from our waters; but when we take into consideration the fact that all unfair means are resorted to for the purpose of increasing the catch, we are no longer at a loss to account for their scarcity.

If our fishermen would but pay a decent respect to the laws, and furthermore would capture only a sufficiency for the supply of the market with fresh salmon, our rivers, with assistance from the State in the way of restocking at intervals, might still continue to be productive for an indefinite period.

There is one source of waste, as we look upon it, however, which should be prevented by the authorities, viz.: the canning interest. From time to time the Government has expended large sums of money for the purpose of stocking our rivers with salmon. This is the act of a paternal government with the sole idea, as we view it, of furnishing to all of the inhabitants of the State, so far as it is possible to do so, an opportunity for supplying the table with a cheap, nutritive article of food.

The taxpayers at large are called upon to pay the cost, and all are alike to share in the benefit. Let us examine for a moment, to see if there is a fair distribution of the results of this outlay. If, as has been previously stated, after the stocking of the rivers, fishing was conducted in accordance with the laws (fishing being prohibited during certain days, in order that a percentage of the breeding fish might escape); also, that the close season should be strictly observed, and further, that the exportation of fish should cease under these conditions, we believe that our rivers would, for an indefinite period, continue to furnish salmon in quantity sufficient to meet the home demand.

No sooner, however, does the salmon appear in tolerable abundance than the canner begins his work. Either by hiring boats and fishermen himself, or by offering tempting rewards to the fisherman for his catch, he is enabled to cover the river with boats in such numbers as to capture a large proportion of the product of the stream before they can pass his establishment.

If the fish so captured from the Government preserves were distributed as canned provisions among our people, there would be some slight

excuse; but when we come to learn that all, or nearly all, are shipped away to foreign countries, we begin to realize that the people are being defrauded of their just dues.

The canner may claim that he is realizing but a small percentage of profit, or he may affirm that he has met with material loss, yet this has nothing to do with the subject. He is responsible for the increase of the price of fresh fish, and he is to be blamed for the final exhaustion of the rivers. There is no river, however rich it may be in salmon, but must eventually become impoverished if the canner is to be allowed to pursue his vocation, even when under limited Government surveillance.

During one year, some time back, there were two thousand men and one thousand boats engaged in the salmon fisheries of the Sacramento River alone. How many of these were employed by the canners we are unable to determine. As his means of canning fish are practically unlimited, and he has the world for a market, the canner has but to increase his fishermen until the stream is so far exhausted as to be of no further value.

In our judgment, the business of the canner should cease, or else the Government should abandon the plan of stocking the rivers when the results are so unsatisfactory.

We feel that this is a question of the greatest importance, and that the attention of the authorities should be called to it, and that the facts should be set forth so clearly as to induce them to take steps to remedy the evil.

To illustrate the case still more fully, we will suppose that our rulers should, while acting in the capacity of a paternal government, determine to set aside a large tract of land for a deer park, where large bands of these animals might be cared for with the view ultimately that venison should be furnished cheaply at certain seasons to the people of the State. What would be said of the economy of such a proceeding if the Government, during the hunting season, should permit individuals to kill the deer without hinderance for the purpose of canning the flesh so secured and sending it away to a foreign market?

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